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PREFACE.

HERETOFORE the report has been issued in the summer, but this year it was decided to delay its publication until the appropriation had been made by the Trustees.

The manuscript was received from the contributors on November 1, and, owing to their promptness and active coöperation, the editors are enabled to issue the report on December 1.

This year the Boston City Hospital Alumni Association placed $150 at the disposal of the editors, to be expended at their discretion. A portion of this money has been spent for illustrating this volume. This money is of great value to the report, in that it enables contributors to illustrate their articles and allows the appropriation of money of the Trustees to be used for printing a larger volume.

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A LIST OF THE TRUSTEES, THE MEDICAL AND SURGICAL STAFF, AND THE HOSPITAL OFFICERS.

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I.

FIVE CASES OF INJURY OF THE CORD, RESULTING FROM FRACTURE OF THE SPINE.

By John Jenks Thomas, A.M., M.D.

[From the Pathological Laboratory of the Boston City Hospital.]

Since the writing of a previous paper[1] upon injury of the cord resulting from fracture of the spine, five additional cases of this injury have come to autopsy at the Boston City Hospital. These cases form the subject of the present paper, and I wish here to express my thanks to Dr. Gavin, Dr. Monks, Dr. Thorndike, and Dr. Jackson, under whose care the patients were during their stay in the hospital, for their kind permission to make use of their notes upon the cases, as well as to Dr. Councilman and Dr. Mallory for placing the material at my disposal. In these cases, where permission was obtained, a portion of the spinal column was removed, and later this was sawed in a sagittal direction in order to show the nature of the injury to the bones and their relation to the spinal cord. For this reason the spinal cord was in most cases divided so that it was impossible to make use of it for microscopical examination, although in one case (Case I.) where a rather short piece of the spinal column was taken the cord was removed before sawing the bones by running a slender knife between the dura and the vertebræ from above and below, and in this way severing the nerve roots and other attachments of the cord, which was then removed entire. Sections were then made at various levels and studied micro-

[1] Thomas, J. J.: Two Cases of Injury of the Cord Resulting from Fracture of the Spine. Boston Med. and Surg. Journal, 1899, cxli., 233 and 259.

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scopically, as was also done with the cord from another case (Case III.) in which permission to remove the spine was refused. It is, however, in every case, easy to see that severe injury had been done to the spinal cord, from the discoloration from hemorrhage, and from the softened consistence of the cord at the point of injury, evident even after hardening in formalin. In one case (Case IV.) the cord was so softened that its substance was removed by the saw, leaving only the stained and empty meninges at the point of injury, and this after hardening for some three weeks in formalin. While the absence of microscopal examination in three of these five cases is to be regretted, nevertheless the condition found in two of these cases where the cord was examined, as well as that in the cases reported in my previous paper, and in the case reported by Dr. Courtney in the Ninth Series of the Medical and Surgical Reports of the Boston City Hospital,[1] perhaps allows us to draw the conclusion that hemorrhage, most marked in the central gray matter, and breaking and crushing of the nerve fibres, were the pathological conditions present which produced the softening and discoloration at the seat of injury in the three cords not examined microscopically.

The cases were as follows:

Case I. ('99-76.) — The patient, a man, A. H., entered the hospital on the service of Dr. Monks on May 11, 1899. He was a machinist, sixty-two years of age, and unmarried. That morning he fell out of bed, falling about seven feet. There was no history of the accident beyond this statement. He was soon picked up, and it was then found that he was unable to move either the arms or the legs, and he was brought to the hospital. The examination at entrance states that the odor of alcohol was noticed on the breath, and the patient was somewhat under the influence of alcohol, but conscious. There was a lacerated wound exposing the cartilage on the posterior surface of the right ear, but no other wounds about the head. The pupils were equal, and reacted to light. The patient lay with his forearms flexed, and somewhat rigid, and there was some voluntary movement of both upper arms, more of the right than of the left. He was unable to move either leg. The knee jerks were present. There was partial anesthesia over the legs, trunk, and part of the

[1] Courtney, J. W.: The Clinical and Pathological Reports of a case of Fracture of the Spine in the Cervical Region. Med. and Surg. Reports, Boston City Hospital, 1898, 9th series, 150; also Boston Med. and Surg. Journal, 1898, cxxxviii., 29.

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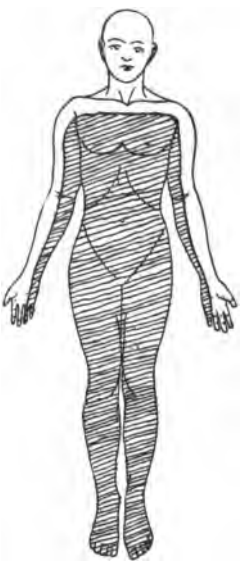
arms. Moderate amount of tenderness between the scapulæ in the back. Over the entire body there was an erythematous rash. The pulse was of good strength, and the breathing was by use of the diaphragm alone. There was retention of urine. On May 15 the patient was seen by Dr. Knapp in consultation, and it was then noted that he could move both arms a little at the shoulder (deltoid) and could pronate and supinate the right wrist. The arms were held abducted and flexed at the elbow. There was some unconscious movement of the legs. The knee jerks were present and equal. The sensation was much diminished over the area which is shaded in the diagram, but he could feel a sharp prick on the right foot, though not on the left. Dr. Knapp diagnosed a fracture or dislocation of the vertebræ, and an injury to the cord at the sixth and seventh cervical segments, not a complete crush. The conditions were explained to the patient, and, at his request, laminectomy was done. An incision was made by Dr. Monks over the third, fourth, fifth, and sixth cervical spines, the muscles were freed, and the laminæ of the fourth cervical vertebra were removed, and the dura exposed. This was covered by a clot, dark in color, about 0.4 cm. in thickness, which was found to extend downward as far as the sixth cervical vertebra, but growing thinner below than above. The clot was removed and the wound irrigated, and the dura was found normal in color and contour, and not lacerated. The cord felt somewhat softened towards the fourth cervical vertebra. Two gauze wicks were inserted, and the wound partially closed with silk sutures. The condition of the patient remained about the same, the retention of urine continuing, until the next morning, when the pulse and respiration began to fail, and the patient died at a quarter past eight on the morning of May 16, some twenty hours after the operation. His temperature throughout was normal.



Autopsy May 16th, by Dr. Thomas. Body of a man about medium size and well developed. Post-mortem rigidity well marked. Only a small incision in the back of the neck allowed. There is an operation wound in the lower part of the back of the neck, about 18 cm. in length, closed by five sutures. This incision was enlarged to about 38 cm. The spine and transverse processes of the seventh cervical, and first and second dorsal vertebræ are absent, having been removed at operation. The upper dorsal and most of the cervical

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vertebræ with the spinal cord were removed. There is a dislocation between the sixth and seventh cervical vertebræ with fracture of the intervertebral disk, and a small portion of the ventral and upper part of the body of the seventh cervical vertebra remains attached to the sixth vertebra. On the left side the fracture is through the transverse processes of the seventh vertebra and of the articular processes. On the right side the ligaments of the articular processes are ruptured, but there is no fracture of the bones at this point. The anterior ligament of the spinal canal is intact. There is a considerable amount of movement possible between the two vertebræ, although no pressure upon the cord was found when the spinal canal was examined. There is a small blood clot about 0.5 cm. in length beneath the dura, which had been opened for a short distance at the upper part of the opening into the spinal canal. The spinal cord at the upper part of the opening, at the junction of the sixth and seventh cervical segments, was much softer to touch than normal over an extent of about half a centimeter. After hardening in formalin the cord was removed from the spine by passing a slender knife between the dura and the bones, and on section it showed a discoloration of the central portions over an extent of about half a centimeter in the region of the sixth and seventh cervical segments. The remainder of the cord appeared normal. The bones of the spinal column were sawed in two portions, the section passing nearly through the spinous processes, and the centre of the bodies of the vertebræ. There was then seen to be nearly a pure dislocation between the sixth and seventh cervical vertebræ, the fracture passing through the intervertebral disk, a small fragment of the upper part of the ventral portion of the body of the seventh vertebra being separated, and remaining attached to the sixth vertebra.

Microscopical examination. — Sections were made at various levels of the cord, and stained hematoxylin and eosin; hematoxylin followed by picric acid and acid fuchsin; by Weigert's myelin sheath stain; and by Marchi's method. Sections from point of greatest injury show a few hemorrhages in the gray matter of the cord, for the most part small, and in the immediate neighborhood of blood vessels, but there are a few larger ones radiating from the centre, usually extending out into the dorsal horn. Rarely there is a very slight infiltration with lymphoid and plasma cells about some of the larger blood vessels and dilated lymph spaces. All the blood vessels are greatly dilated. Aside from the hemorrhage there is not much destruction of nerve tissue. The nerve cells show a much greater amount of pigment than would be expected normally. The white substance of the cord shows practically no hemorrhage, though in one or two instances there is seen a slight hemorrhage about a blood vessel. The blood vessels are greatly dilated. There is very

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marked edema, and many large round spaces, some of which are empty, and others contain in the centre a swollen nerve fibre. Many portions show an irregular arrangement of nerve fibres, many of which are seen cut diagonally, or longitudinally instead of transversely, as if the fibres had been twisted and distorted by the trauma. This portion shows well marked but diffuse degeneration of both axis cylinders, and myelin sheaths by Marchi's method, which is perhaps slightly more marked in the posterior columns. There are, however, still many axis cylinders which appear normal, though perhaps half of all of them are either swollen or degenerated. The most marked thing in these sections is the edema. The nerve roots at this level show a marked dilatation of the blood vessels, and also, by Marchi's method, degeneration of the axis cylinders, and myelin sheaths, affecting one or the other in approximately between one-fourth and one-third of the nerve fibres. Throughout the sections both in the nerve substance proper, and in the pia there are very numerous corpora amylacea. In general, the sections show very little inflammatory reaction, though occasionally in the pia there is found a small area containing many lymphoid and plasma cells, but compound granule cells, and large phagocytic cells were nowhere seen.

The sections taken from other levels of the cord show the same edema of the white substance, with swollen and absent nerve fibres, and many corpora amylacea, and dilated blood vessels, as well as degenerated axis cylinders and myelin sheaths by Marchi's method, though to a less extent than in the sections nearest the point of injury, while the hemorrhages are absent, as well as the broken and distorted nerve fibres.

The sections from the lower thoracic cord, at a still greater distance from the point of injury, show practically a normal condition, except that there is some dilatation of the blood vessels of the cord and of the nerve roots, and a slight diffuse degeneration of axis cylinders and myelin sheaths shown by Marchi's method at the periphery of the cord, and in places there are to be seen in the pia connective tissue cells, which show the presence of numerous fat drops. Degeneration of nerve fibres in the nerve roots, both anterior and posterior, is present to a moderate degree in sections from all levels of the cord.

Anatomical diagnosis. — Dislocation of the sixth cervical vertebra upon the seventh, with rupture of the intervertebral disk, and fracture of transverse and articular processes. Crush of the sixth and seventh cervical segments of the cord with small hemorrhages into the substance of the cord near the point of injury, and dilatation of the blood vessels ; marked edema of the cord ; diffuse acute degeneration of axis cylinders and myelin sheaths throughout all par tsof the cord; slight inflammatory infiltration with lymphoid and plasma

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cells about some of the blood vessels of the cord and pia; moderate acute degeneration of nerve fibres of the ventral and dorsal nerve roots, with dilatation of their blood vessels.

Case II. ('99–93.) — The patient, a man, R. P., thirty-one years of age, entered the hospital on June 12, 1899, on the service of Dr. Thorndike. At about eight o'clock that morning while putting up a staging, the ladder, on which the patient was standing, slipped and he fell to the ground, a distance of about twenty feet. He reached the hospital about two hours after. Physical examination showed a well developed man, perfectly conscious, who did not complain of any great discomfort. There was an irregularity of contour to be felt over the two upper dorsal vertebrae, with apparent fracture of the second or third dorsal where there was a marked depression, with prominence of the vertebra above. There was complete paraplegia and loss of sensation from about the level of the nipples, but no paralysis of the upper extremities. The epigastric and cremasteric reflexes were abolished, as were the patellar reflexes, and priapism was present. The case was seen shortly after entrance by Dr. Post, Dr. Thorndike and Dr. Bullard, and laminectomy was deemed advisable, and was requested by the patient. Operation by Dr. Thorndike. An incision 10 cm. long was made over the seat of the injury, the soft tissues divided, and the spine exposed. A fracture was found of the spines and laminæ of the second dorsal vertebra, and the fragments of bone were removed, together with the spines of the first and third dorsal vertebrae. The cord was exposed for about 2.5 cm. and examined. No laceration of the membranes was found or signs of pressure here, or as far above and below as could be examined with the probe. The dura was then nicked, which allowed the escape of clear spinal fluid. During the operation hemorrhage was controlled by temporary packing. A gauze wick was inserted in the form of packing, and the wound was dressed. The patient took the ether well, and made a good recovery from it. The condition remained good, with very little change during the remainder of that day and through the night. The next morning the patient did not seem quite as bright, and the pulse began to fail, but he complained of no pain. About noon the pulse became more rapid and irregular, and the respiration shallow, unconsciousness supervened, and the man died at half past one that afternoon, about twenty-five hours after the operation. The temperature on the afternoon of the 12th was 101.0° F. and on the morning of the 13th 103.° F.

Autopsy June 14, 1899, about twenty hours after death. Dr. Mallory, body; Dr. Thomas, spine. Body 180 cm. in length, well built and muscular. There is a sutured incised wound in the median line over the lower cervical and upper dorsal vertebrae. The operation wound extends down to the cord through the second and third dorsal vertebrae. The spine from the axis to the third dorsal ver-

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tebra was removed entire. The arches and the spinous processes of the second and third dorsal vertebrae are absent. The cord at this point appears normal; it is not softened. There is no hemorrhage in the spinal canal. On the anterior aspect of the vertebral column the sixth cervical vertebra projects anteriorly half a centimeter in front of the fifth, which is dislocated backwards. The fifth vertebra is freely movable upon the sixth, and also the sixth, to a less degree, upon the seventh. The body of the seventh vertebra at its anterior aspect is movable with crepitus, and the spinous process, with a portion of the arch of this same vertebra, can also be moved freely from side to side. There is apparently upon the right side a fracture of the transverse processes of the sixth cervical vertebra.

The heart weighed 330 grammes; flabby; left ventricle dilated, and somewhat hyportrophied. Valves normal. The lungs showed marked hypostatic congestion of the posterior portions. Beyond a moderate congestion of the spleen and kidneys, where the glomeruli appeared as red points, the other organs showed nothing noteworthy.

The spine, with the cord, was hardened in formalin, and sawed in sagittal section, a little to one side of the median line. There was then seen, besides the fracture of the spinous process of the seventh cervical vertebra, that the line of fracture of the bodies of the vertebrae ran from the upper ventral border of the body of the sixth vertebra downwards and backwards diagonally through the bodies of the sixth and seventh vertebrae, with considerable displacement backwards of the upper fragment. The anterior ligament of the spinal column is separated from the body of the fifth cervical vertebra, passing from the projecting upper border of the sixth vertebra to the lower border of the fourth vertebra. The cord for a space of about 3 cm. opposite the bodies of the sixth and seventh cervical vertebrae is softened and dark in color from the presence of blood. Above and below this point the cord appears normal. No microscopical examination.

Anatomical diagnosis. — Fracture of the bodies of the fifth, sixth, and seventh cervical vertebrae, with displacement backward of the upper fragment; fracture of the transverse processes of the sixth and seventh cervical, and the first and second dorsal vertebrae, and of the spinous processes of the seventh cervical, and first and second dorsal vertebrae. Crush of the sixth and seventh cervical segments of the cord, with acute softening of the cord, and hemorrhage into its substance.

Case III. (*99–111*). — The patient, a man, J. K., entered the hospital on July 14, 1899, on the service of Dr. Jackson. No history was obtained except that the patient was found upon a bridge and brought to the hospital by the ambulance. He was well developed and fairly muscular, the pulse slightly irregular, of very poor strength and volume. Pupils were equal, and reacted but slightly. The

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tongue was not protruded. The patient could not speak above a whisper. There was complete paralysis of all the extremities and muscles below the clavicle, and the respiration was entirely diaphragmatic. Priapism was present. Otherwise examination was negative, so far as it could be made. The man lived only twenty minutes after his arrival at the hospital.

Autopsy by Dr. Mallory, July 14, 1899, five hours after death. Body well built and nourished, fairly muscular; length, 172 cm. Pupils equal. Rigor mortis marked.

Spine. — Large hemorrhage into muscles and tissues around the cervical vertebrae. Spinous process and laminæ of fifth cervical vertebra dislocated forward, so that the finger can be passed directly into the vertebral canal above the sixth cervical vertebra, and to the cord. Ligaments on the anterior surface of the spine opposite the lower border of the fifth cervical vertebra torn, and much hemorrhage into the adjacent tissues. There is a small amount of hemorrhage on the surface of the dura in the cervical region, but no blood within the dura. The cord for a distance of 3 cm. over the bodies of the fifth and sixth cervical vertebræ is very soft, and on section the normal markings cannot be made out; the substance of the cord is almost diffluent, reddish in the centre, and white peripherally. Other portions of the cord appear normal on section.

There is a hemorrhage beneath the scalp over an area 4 cm. by 6 cm., near the upper border of the left parietal bone, but no evidence of fracture. The brain weighs 1,265 grammes; there is some compensatory edema of the pia, but no lesions of the brain of any sort are present.

The other organs of the body showed no changes except there was a fracture of the sternum passing obliquely between the second and third costal cartilages, with slight hemorrhages in tissue on upper and lower surfaces; chronic adhesive pleurisy; chronic adhesive peritonitis, and small areas of fatty degeneration in the liver.

The cord was hardened in formalin, and on section there is found in the fifth servical segment a dark brownish area occupying roughly the area of the gray matter of the cord. This discolored central area extends upwards and downwards for a considerable distance, rapidly becoming smaller and more sharply limited. Above it extends in the right dorsal cornu to a level 2.5 cm. above the first section, somewhere about the region of the second cervical segment. On the left side the area of hemorrhage is in the ventral horn and extends about 2 cm. The hemorrhage extends in the gray matter below the first section fully 2 cm.; more marked in the left side, and extending a little further down on this side. Through most of the regions in question more or less of the gray matter of both ventral and dorsal cornua of both sides are affected, but the hemorrhage is in general more marked in the ventral cornua. In the fifth cer-

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vical segment, where the hemorrhage is greatest it occupies practically the whole of the centre of the cord, and radiates towards the periphery of the cord. Below the upper part of the seventh cervical segment the cord appears normal on section.

Microscopical examination. — Sections of the cord were made at various levels and stained with hematoxylin and eosin; hematoxylin followed by picric acid and acid fuchsin; by Weigert's myelin sheath stain; and according to Marchi's method. Sections from the fifth cervical segment show extensive hemorrhage throughout the gray matter of the cord, though they are not sharply confined to it, but in many places radiate out into the white substance. The hemorrhage in most sections while extensive has infiltrated the tissues, and in the destroyed areas there can usually be seen a good many nerve fibres, blood vessels, and nerve cells. Among the red blood corpuscles are scattered a fairly large number of leucocytes, which are filled with many small dark brown pigment granules. These granules are also seen scattered throughout the area of hemorrhage and are apparently derived from blood pigment. At the borders of the hemorrhage, in the ventral cornua, there are seen quite numerous large nerve cells of the motor type, which are also filled with these same small, dark brownish pigment granules. This is most marked in cells lying close to the masses of red blood corpuscles, and becomes rapidly less marked in the cells a little removed from these hemorrhagic areas, and is not noticeable in the cells furthest from them. Neither are these granules seen to any extent in nerve cells in other portions of the cord where no hemorrhages are found, or where the hemorrhages are slight. In portions of the sections from this level there is a moderate edema, most often in the white substance of the cord, and in the neighborhood of the hemorrhages, or at the periphery of the section. There is no evidence anywhere of inflammatory infiltration in the cord, or in the walls of the blood vessels. There is a well marked dilatation of many of the blood vessels of the cord, and also of those of the nerve roots. The nerve roots show no other changes except a degeneration of myelin sheaths and axis cylinders, as shown by Marchi's method, sometimes affecting one, and sometimes the other, or at other times both. This degeneration affects approximately between a fourth and a third of the fibres. There is also a well marked diffuse degeneration of nerve fibres, and sheaths shown by this method throughout the sections at this level, and in certain areas which are edematous this degeneration is extremely marked.

Sections from other portions of the cord, from the eighth cervical segment, dorsal and lumbar regions, show only dilated blood-vessels in the cord, most often and most marked in the ventral horns, and gray commissure of the cord, and also in the nerve roots. In many of the blood-vessels there can be seen leucocytes loaded with pigment

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granules, such as have been described above. There is also seen throughout all these sections a moderate, diffuse degeneration of axis cylinders, and myelin sheaths by Marchi's method, both in the cord itself and in the nerve roots, but this is not more marked in one area than another. The sections stained by Weigert's myelin sheath stain show a slight diffuse degeneration of the posterior columns in the cervical region, but none elsewhere.

Sections from the liver show the degenerated areas to be affected by fatty changes, and those from the liver and spleen show little beyond congestion.

Anatomical diagnosis. — Fracture of fifth cervical vertebra with dislocation of the fifth vertebra forward ; crush of the fifth and sixth cervical segments of the cord, with hemorrhage into the substance of the cord, chiefly into the gray matter, and extending to a greater or less extent from the second to the seventh cervical segments ; dilatation of the blood-vessels of the cord, and nerve roots ; edema of the cord ; diffuse acute degeneration of axis cylinders and nerve sheaths throughout the cord, and moderate acute diffuse degeneration of nerve fibres of ventral and dorsal nerve roots, with dilatation of their blood-vessels; fracture of the sternum; hemorrhage beneath the scalp; chronic adhesive pleurisy; chronic adhesive peritonitis; small areas of fatty degeneration in the liver.

Case IV. (*00-127.*) — The patient, a man, T. B., thirty-three years of age, entered the hospital on the service of Dr. Gavin, on July 19, 1900. That morning he had been thrown from a ladder, while painting the elevated railway structure, and fallen to the street, striking upon his head. He was brought to the hospital four hours after the accident. His pulse was then 100, and his temperature 102.2° F. The patient was delirious and noisy, and would not protrude the tongue. There was ecchymosis and swelling under the right eye, and a scalp wound 15 cm. long, convex upward and forward, in the left occipito-parietal region, without much laceration. The pupils were moderately contracted, equal in size, and reacted. There was apparently a slight outward deviation of the right eye. There was paralysis of the lower extremities, with abolition of the patellar, plantar, and cremasteric reflexes, and complete anesthesia up to the seventh rib in the axillary line, and to the upper end of the xiphoid cartilage in the median line. The spine presented an unnatural curve, with the convexity forward, beginning at about the fifth cervical vertebra, and extending down to the second or third dorsal vertebra. The deeply buried spinous processes, however, were regularly and evenly placed in relation to each other. There was also a small knuckle lower down, at about the fifth dorsal spine, and there was a sensation of crepitus over this knuckle, and this sensation was accentuated on hyperextension of the back, which also

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tended to obliterate the knuckle. There was eversion of the right lower extremity, with shortening of 1.8 cm. in the distance from the anterior superior spine of the ilium to the internal malleolus, and the right greater trochanter apparently rotated with the shaft in a diminished arc, but there was no crepitus in the right femur. There was also a fracture near the proximal end of the right first metacarpal bone. The temperature in the afternoon of the 19th was 98.8° F.; the morning of the 20th, 98.8°, and in the afternoon, 99.0°; and, on the morning of the 21st, 102.4°, and that afternoon the same. During this time there was complete retention of urine, the abdomen became excessiveiy distended, tympanitic on percussion, so that it hampered respiration greatly. This was carried on almost entirely by the diaphragm, with very little costal movement, and death ensued about half-past two o'clock in the morning, nearly three days after the accident.

Autopsy, July 23, 1900, thirty-one hours after death. Body of a man, well developed and nourished, 168 cm. long. Rigor mortis present in both lower and upper extremities. Pupils equal and dilated. Bruise of tissue about the right eye, but no edema present. Over the region corresponding to the left parietal bone there is an irregular scalp wound, beginning at a point about 3 cm. above the external auditory meatus, and extending upward and backward towards the left parietal eminence, and measures 15 cm. in length. The edges of this wound are held together by twelve stitches, and upon removal of these, the edges of the wound are separated with some traction, healing having advanced well. Separation of the wound shows that this flap of scalp described is completely stripped from the skull. There is a definite prominence over the region corresponding to the fourth and fifth dorsal vertebræ.

Brain.—Weight, 1,465 grammes. Convolutions somewhat flattened. Over both parietal lobes there is considerable injection of the vessels, and marked hemorrhage under the pia. The hemorrhage is diffuse, and of bright red color for the most part. One area darker red than the rest, and also more marked because of greater quantity of blood, is situated on the right side near the junction of the fissure of Rolando with the superior longitudinal sulcus; it measures 1.5 cm. in diameter. There is also marked hemorrhage beneath the pia over the area corresponding to the occipital bone. The vessels of the base of the brain show no sign of sclerosis.

The vertebral column was removed, and shows a fracture of the bodies of the fifth cervical, and also of the fifth and sixth dorsal, vertebræ; movement of these bodies is distinct, and rather free.

Aside from the brain and spinal cord there was noted some distention of the intestines, especially the large intestine, some general edema of the lungs, and hypostatic congestion, most marked in the lower lobes of both lungs, and marked congestion of the trachea.

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The spine, from the second cervical to the tenth dorsal vertebra, was removed, and after hardening in formalin was sawed longitudinally in sagittal section.

The fifth cervical spinous process is abnormally movable, but there is no sign of compression of the cord or of hemorrhage into the substance of the cord or into the membranes at this point, and the bodies of the vertebræ are not abnormally movable. There is a fracture of the tip of the fourth dorsal spinous process at about its middle, but the arch of this vertebra is firm. The fifth dorsal spine is broken near its base, but here again the arch is uninjured. The sixth dorsal spine is fractured, and its tip is freely movable, while the proximal fragment is firmly attached on the left side, though on the right side there is a fracture through the lamina and transverse process. There is also a fracture of the body of the sixth dorsal vertebra, passing diagonally downward and forward from about the middle of the upper surface of the body. From this point back to the vertebral canal the line of fracture passes through the intervertebral disk lying between the fifth and sixth dorsal vertebræ. The cord opposite this intervertebral disk, for a distance of 1.8 cm., is completely absent, the empty meninges cut in half, and stained dark by blood, only remaining. The blood and crushed nerve structures have fallen out in the process of sawing the specimen. The lower part of the cord extends as a fairly firm, rounded end into the cavity left in the empty meninges. The upper end of the cord is slightly concave, and is much softened and discolored by blood for a distance of nearly 2 cm. upwards, to a point about opposite the upper border of the body of the fifth dorsal vertebra. The lumen of the spinal canal at the point of fracture is not narrowed to any great extent, but the upper portion of the lower fragment can easily be brought in contact with the arch of the fifth dorsal vertebra by flexing the spine, and the displacement forward of the upper fragment of the spine can be completely corrected by hyperextension of the vertebral column. No microscopical examination.

Anatomical diagnosis. — Fracture of the fifth cervical spine; fracture of the fourth, fifth and sixth dorsal spines, the lamina and transverse process of the sixth vertebra, and of the body of the same vertebra, with displacement forward of the upper fragment; crush of the third, fourth, fifth and sixth dorsal segments of the cord, with acute softening of the cord, and hemorrhage into its substance; hemorrhage beneath the pia of the brain; laceration of the scalp; hypostatic congestion of the lungs; edema of the lungs; emphysema of the lungs; congestion of the trachea; parenchymatous degeneration of the liver; healed pulmonary tuberculosis; localized chronic fibrous pericarditis; chronic aortitis.

Cultures. — Heart and spleen, sterile; liver and kidney, bacillus coli communis; lungs, streptococcus pyogenes, and bacillus coli communis.

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Case V. (*'00–156*). — The patient, a man, T. P., thirty-nine years of age, entered the hospital, on the service of Dr. Monks, on September 10, 1900. He had fallen down a flight of stairs thirty-eight hours before, immediately became unconscious, and this had lasted four hours. Subsequently it was found that he was unable to move the lower extremities, and that sensation was lost in them. The paralysis and anesthesia had not progressed. At entrance the pulse was 86 and of good strength, and the temperature 100° F. He was pale, yawned constantly, was somewhat indifferent, but had a somewhat anxious expression. The pupils were contracted, and responded in a very limited arc to light. The tongue was protruded in a straight line. The shoulders could be elevated feebly, and there was some power of abduction and adduction of the arms. The forearms could be flexed somewhat more strongly. The fingers were hyperflexed, and the grasp was nil. The breathing was practically entirely diaphragmatic, the ribs moving very slightly, and the abdomen was much distended. There was complete paralysis of both legs. The abdominal reflexes were abolished. There was moderate-priapism, and a very slight cremasteric reflex on the right. There was a slight remnant of the plantar reflex on the left, the third toe being drawn down, and on the right there was a slight drawing down of the third and fourth toes upon irritating the sole. The patellar reflexes were absolutely absent. There was absolute analgesia of the lower extremities, and of the trunk as high as the nipple on the left, and up to the second rib on the right side, while in the upper extremities there was an area of absolute anesthesia corresponding almost exactly to the area of distribution of the ulnar nerves. The case was seen by Dr. Courtney in consultation, but it was deemed inoperable. The distention of the abdomen, and the difficulty in breathing steadily increased, and the patient died at 3 P.M. on the 12th. The sensorium remained clear.

Autopsy, September 13, 1900, nineteen hours after death. Body of a man, well-developed and nourished. Rigor mortis marked. Pupils equal and slightly dilated. There is a bruise above the right elbow, and a contusion of the anterior portion of the scalp. Brain. In the connective tissue beneath the scalp there is a flattened bloody tumor, 10 cm. in diameter, lying over the anterior part of the vertex of the skull. The dura shows a few small interstitial hemorrhages. On the orbital surface of the frontal lobes there is some yellowish discoloration, and superficial softening of the convolutions. Both lateral ventricles contain a moderate amount of reddish fluid. Section of the cerebrum and cerebellum shows nothing abnormal. The spine and cord were hardened in formalin, and later were sawed in sagittal section. There is a dislocation of the sixth cervical vertebra forward upon the seventh vertebra, with a fracture passing through the intervertebral disk, and involving the upper

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ventral part of the body of the seventh vertebra, the line of fracture passing downwards and forwards. There is also a fracture of the arch of the sixth vertebra, so that its spinous process is freely movable, and the tip of the spinous process of the seventh vertebra is also fractured. There is considerable forward dislocation of the upper fragment of the spine, and the upper posterior border of the body of the seventh vertebra projects into the lumen of the spinal canal, narrowing it slightly. Opposite this projection for a space of nearly 3 cm. the cord is dark in color, and softer than the remainder of the cord, and there is in the centre of this discolored area for a distance of about 1 cm. considerable dark, reddish brown discoloration, evidently from the presence of blood.

The lungs were dark red in color, deepest at the lower lobes, firm, crepitant, and contained abundance of fluid. There was also noted a slight chronic endocarditis of the mitral valve, and a cyst of the kidney.

Anatomical diagnosis. — Fracture of the seventh cervical vertebra with fracture of the intervertebral disk between the sixth and seventh vertebrae, with dislocation forward of the upper fragment; fracture of the arch of the sixth, and of the spinous process of the seventh cervical vertebra; crush of the sixth and seventh cervical segments of the cord, with acute softening of the cord, and hemorrhage into its substance; laceration of the cerebral cortex of the inferior surface of the frontal lobes; bloody fluid in the lateral ventricles; slight hemorrhage of the dura; hematoma of scalp; edema of lungs; cyst of kidney; slight chronic mitral endocarditis.

In these five cases the point of injury of the cord in four was in the cervical region, and in one in the upper dorsal region. In one case (Case III.) there was fracture and dislocation of the fifth cervical vertebra, with crushing of the fifth and sixth cervical segments of the cord. In three cases (Cases I., II., and V.) the sixth and seventh cervical vertebræ were fractured, or dislocated with crushing of the sixth and seventh cervical segments of the cord, and in one case (Case IV.) there was fracture of the sixth dorsal vertebra, and dislocation of the fifth vertebra upon the sixth, which produced a very extensive crush of the cord, with hemorrhage into its substance, involving the third, fourth, fifth, and sixth dorsal segments. In three cases there was no note of deformity of the spine. In the second case there was depression of the third dorsal spine, and at the operation this was found to be fractured, but the injury of the cord was due to a fracture of the

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sixth and seventh cervical vertebræ, with dislocation backward, and crush of the sixth and seventh cervical segments, showing that in this case the better guide to the location of the injury would have been the height of the disturbance of sensation, rather than the movable spine. In the fourth case there was a knuckle at the fifth dorsal spine, and the fracture was through the body of the sixth dorsal vertebra, with dislocation of the fifth vertebra upon the sixth. In this case the deformity was important as a guide to the location of the injury. The paralysis in all the cases came on at once at the time of the accident, and in four cases the paralysis of the lower extremities was complete, and in one case (Case I.) there was slight power of motion left. In this case there was some movement of the arms, the paralysis sparing the movement of flexion of the forearms, and abduction and adduction of the arms, the paralysis being of the so-called lower arm type, involving the triceps and the muscles of the forearm, with the exception of the supinators. In this case there was observed the characteristic position of the arms, with the forearms flexed, and arms abducted, seen in paralysis from injury of the seventh cervical segment. This same distribution of paralysis was also seen in Case V. In Case II., on the other hand, where the injury of the cord was at nearly the same level, there was no paralysis of the arms noted. In Case III., where the injury involved the fifth cervical segment, the arms were completely paralyzed, and in Case IV., as was to be expected, the arms were unaffected. In the first case, where both from the symptoms and from the microscopical examination of the cord, we have every reason to suppose that the injury was only partial, the knee-jerks were present. In Case III. they were not recorded, and in the other cases they were absent. This confirms the conclusion as to the diagnostic value of the absence of the patellar reflex in injuries of the cervical and upper dorsal cord, which I have drawn in a former paper,[1] where this phenomenon is discussed at some length. In one case there is no note of the paralysis of the muscles of the chest wall, but in all the others this was noted as being present, respiration being

[1] *Loc. cit.*

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carried on chiefly or entirely by the diaphragm. In three cases retention of urine is noted, and in three priapism is stated to have been observed, one or the other condition having been present in every one of the five cases. In regard to the other reflexes the condition varied. The plantar reflex was absent in Cases II. and IV., and slight in Case V. The abdominal reflex was absent in Cases II., IV., and V., and the cremasteric reflex was absent in Cases II. and IV. and slight, on the right only, in Case V. The condition of the sensation was noted with greater or less care in all of the cases, except Case III., which lived too short a time for any careful examination. In Case I. the area of disturbance of sensation involved the lower extremities, trunk, and the ulnar side of the fore and upper arms, as is usual in injuries of the cord at the seventh cervical segment, as determined by Kocher,[1] though sensation was not completely lost, but retained to strong stimuli, as one would expect in a partial lesion. The area in Case V., over which there was loss of sensation, was very similar to that in Case I., and the injury to the cord was at about the same level, but the disturbance of sensation was absent over the inner side of the upper arms. In Case IV. the paralysis of sensation was complete, as is natural, but did not extend as high as one would expect, judging from the situation of the injury to the cord, the notes stating that it extended to the seventh rib. The point of greatest injury, however, was opposite the upper border of the sixth dorsal vertebra, which would correspond to the lower part of the sixth and the seventh dorsal segments of the cord, but the hemorrhage into the cord involved a much greater portion above, as well as below, this point. Yet the hemorrhage may have been confined closely to the gray substance of the cord, as in Case III., and in the cases previously reported by me; or it may have been that the area of diminished sensation increased in the interval between the accident and death, as softening of the cord became more marked. In all the cases the portion of the cord which was

[1] Kocher, T.: Die Verletzungen der Wirbelsäule, zugleich als Beitrage zur Physiologie des menschlichen Rückenmarks, Mitt. a. d. Grenzgeb. d. Med. u. Chir., Jena, 1896, i, 415. Die Läsionen des Rückenmarks bei Verletzungen der Wirbelsäule. *Loc. cit.*, 481.

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injured by crushing or hemorrhage was rather great, and extended above and below the point of crushing of the cord. There was no note of the presence of pain in any of the cases, nor was variation of the symptoms noted. As to duration of life after the accident, one case (Case III.) lived twenty minutes only after entrance to the hospital, but it was not known how long before that the accident took place. Another case (Case II.) lived twenty-nine hours; one (IV.), three days; one (V.), three days and a half, and the other (I.), five days. In two cases (I. and II.) an operation was performed, and it is interesting to note that in both the opening of the spinal canal was too low. Once, in Case II., the surgeons were misled by taking as a guide the depression and crepitus at the third dorsal spine, while the event proved that the chief injury was a fracture through the bodies of the sixth and seventh cervical vertebræ, with dislocation backward of the upper fragment, the line of fracture passing from a point above and anterior, downward and posteriorly. This direction of the line of fracture seems to be exceedingly rare. Wagner and Stolper[1] give examples more or less marked of fracture in this direction, but Kocher[2] gives none, and though he speaks of cases in which the line of fracture extended diagonally from side to side, he makes no mention of this form, nor does Thorburn[3] give any cases resembling this one. In this case death took place twenty-nine hours after the accident, and twenty-five hours after the operation. In the other operative case (Case I.) the highest point of the cord exposed was just about the level of the injury. Both Thorburn and Kocher call attention to the danger of operating too low. This is explained by the fact that the injury is apt to be greatest in the centre of the cord, chiefly because of its less dense structure and greater vascularity, and that the lower sensory fibres in the cord lie nearest the gray matter, toward the centre of the cord. This fact may easily lead us to place the point of injury lower than it really lies, and this without taking into

[1] Wagner, W. and Stolper, P.: Die Verletzungen der Wirbelsäule and des Rückenmarks. Deut. Chirurgie, Lf. 40, 1898, in Figures 117, 143, and 151 (pp. 314, 438, and 445).

[2] *Loc. cit.*

[3] Thorburn, W.: A Contribution to the Surgery of the Spinal Cord. London, 1889.

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account the known lack of correspondence between vertebræ and spinal segments. This case lived five days in all, and twenty hours after operation, and this was a case in which there was a partial lesion only, though a severe one. No pressure was found upon the cord, and the autopsy showed an almost pure dislocation of the sixth cervical vertebra upon the seventh. Operation in this case certainly was of no use, and one cannot help wondering whether the moving of the patient might not have increased the injury. In Case III. the spine was not removed, and it was impossible to determine exactly the line of fracture, but it apparently involved only the body of the fifth cervical vertebra, and the dislocation of the upper fragment was forward and extreme. This case was the only one of the series which showed fracture of the sternum, a fairly frequent accompaniment of fracture of the cervical vertebræ, supposed to be produced by the impact of the chin upon the sternum. This fracture can often be diagnosed during life by the line of ecchymosis across the sternum. The other cases showed the usual fracture, passing downward and forward from a point above and posterior, with forward displacement of the upper fragment. In all the cases except the first it was possible to say from the symptoms that we had to do, in all probability, with a total transverse crush of the cord. I have in a previous paper[1] endeavored to give the points upon which we can base such a conclusion.

Factors in drawing the conclusion that there is a complete transverse lesion of the cord are:

1. Complete paralysis, usually of a flaccid type.
2. A complete loss of sensation in all its forms.
3. Absent reflexes, especially the knee-jerk, while the plantar reflex on the contrary is often retained.
4. Complete paralysis of the bladder and rectum, with priapism.
5. Vaso-motor paralysis, with severe sweating in the paralyzed parts.
6. And most important, absence of variations in the symptoms.

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[1] *Loc. cit.*

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Wagner and Stolper add to these a correspondence between the motor and the sensory paralysis, and their symmetry, but this in complete transverse lesions may be disturbed by the hematomyelia, which often extends higher on one side of the cord than on the other, and may be either in the central gray matter, or in the posterior columns. They also add, and quite correctly:

7. Absence of irritative phenomena, such as pain.

Kocher divides the injuries of the spine as follows:

A. Partial.

1. *a.* Contusion.

b. Distortion. These are usually without injury to the cord, but may involve the nerve roots, or be accompanied by central hematomyelia.

2. Isolated fractures of arches and spines.

3. Luxations of articulations.

4. Compression fractures, of bodies, or intervertebral disks.

B. Complete, luxation fractures.

1. Pure luxations.

2. Luxation fractures.

a. Luxation with compression fracture.

b. Luxation with diagonal fracture.

The treatment of these various forms must vary with the nature of the injury. In some of the partial forms injury of the cord may be absent or slight. In the severer forms the nature of the injury will vary more with the nature of the accident than with any other factor. These may be divided into three groups.

1. Those producing direct crushes of the arches, as by direct blows, either from the fall, or from some weapon, or a bullet. Thorburn thinks that these are pre-eminently the cases in which operation is indicated, while Wagner and Stolper consider these cases, together with some where the cord has been injured by a stab, to be the only ones requiring early operative interference, while they limit the late operation to cases where a later increase of the symptoms can be ascribed to adhesions in the membranes of the cord, arising during the process of healing.

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2. Falls upon the head, buttocks or feet, producing usually compression fractures.

3. Forced flexions, or more rarely extensions of the spine, producing dislocations, either with or without fractures of articular processes and vertebral bodies.

In these last two classes of injuries the former will seldom produce permanent pressure upon the cord from bony fragments, because of the strong ligament lying posterior to the bodies of the vertebrae, which is seen intact in all our cases. The latter class of injuries is the one which usually produces the complete luxation fractures, and in our five cases there was never found continued pressure from bone or hemorrhage, and this is also true of all the cases (eleven) which have come to autopsy at the Boston City Hospital since 1881. In these four cases, what narrowing of the spinal canal was present could be obliterated very nearly or entirely by moderate backward flexion of the spine, with more or less extension. This was shown especially well in the spine from Case IV., of which two photographs are given, one of the spine as sawed, and one of the spine held in a position of hyperextension simply, without extension. (Case IV., A and B.) On the other hand, marked narrowing of the spinal canal could be produced in these spines by very moderate flexion, a fact which cannot be carried too constantly in mind while examining, or handling these cases.

These cases of luxation fracture of the spine should be treated by hyperextension of the spine, with moderate extension, and fixation of the spine. Unfortunately in many of these cases the injury of the cord is a complete one, many cases reported by Wagner and Stolper, Kocher and others showing that even complete rupture of the cord is not extremely rare, and in all cases of complete transverse lesion of the cord the duration of life will depend chiefly upon the height of the injury, and no restoration of function can be hoped for by any therapeutic measure, operative or non-operative.

CONCLUSIONS.

1. Deformity of the spine may be an important guide to the location of the point of injury of the cord, but one should

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guard against the danger of being misled by multiple injuries and unusual direction of the line of fracture.

2. Sensory and paralytic symptoms are of the greatest value for the diagnosis of the location of the injury to the cord, but it must be borne in mind that this is apt to be even higher than these symptoms would indicate.

3. It is usually possible to correct the narrowing of the spinal canal in the cases of fracture dislocation by hyperextension, and extension of the spine.

4. The extent of injury to the cord from hemorrhage may be very great.

5. The nature of the injury in these cases varies more with the nature of the accident than from anything else, hence the importance of obtaining as good an account as possible of the way in which the injury occurred.

6. Early operation should be limited to cases where direct crushing of the arches is thought to be present, and to certain cases of bullet and stab wounds of the cord.

7. The late operation is indicated in those cases where a later increase of the symptoms seems to point to an adhesive healing process in the membranes of the cord.

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DESCRIPTION OF PLATES.

Case I. — Spine in sagittal section, showing fracture through the intervertebral disk between the sixth and seventh cervical vertebræ with dislocation forward of the upper fragment. Partial crush of cord. First and second dorsal spines removed at operation.

Case II. — Spine in sagittal section. Fracture of spinous processes of seventh cervical and first dorsal vertebræ. Fracture of the bodies of the fifth, sixth, and seventh cervical vertebræ with displacement *backward* of upper fragment. Total crush of cord. Staining of cord by blood shows through the membranes, the section having been made a little to one side of the cord. Spinous processes of second and third dorsal vertebræ were found fractured at operation, and removed.

Case IV. — A and B. Spine in sagittal section. Fracture of spinous processes of fifth cervical, and of fourth, fifth, and sixth dorsal vertebræ. Fracture of the body of the sixth dorsal vertebra. Displacement forward of upper fragment. Total crush of cord, the softened substance of which was removed by the saw, leaving only the empty and blood-stained membranes at this point. A, shows this spine in the natural position assumed by the fragments. B, the same spine hyperextended, showing the obliteration of the narrowing of the canal.

Case V. — The two halves of the spine sawed in sagittal section. Fracture of the seventh cervical vertebra, with dislocation forward of the upper fragment. Fracture of the arch of the sixth, and of the spine of the seventh cervical vertebræ. Total crush of the cord. The discoloration of the cord from blood shows plainly in the plate.

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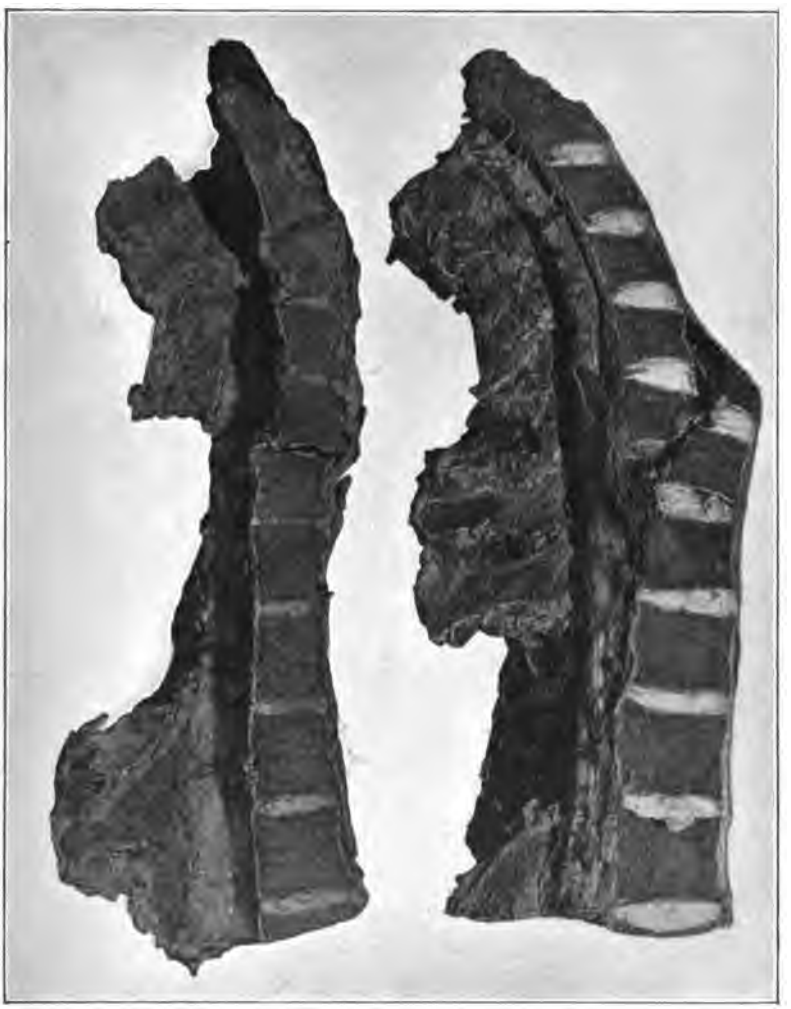
PLATE I.



Case I. Case II.

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PLATE II.

Case IV. B. Case IV. A.

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PLATE III.

Case V.

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II.

A PLEA FOR LARGER DOSES OF ANTITOXIN IN THE TREATMENT OF DIPHTHERIA.

By John H. McCollom, M.D.

Since 1878, when a report of each case of diphtheria was required by the Board of Health, Boston has suffered more than any other of the large American cities from the inroads of this disease. During this time, particularly from 1878 to 1894, a comparison made with some of the foreign cities is not favorable to Boston. The actual number of deaths each year from diphtheria has varied from 817 in 1894 to 170 in 1898. The percentage of mortality to the number of cases in the city at large has ranged from 35.7 in 1881 to 9.76 in 1899. Some of this diminution in the mortality percentage may be explained by the fact that by means of a bacteriological examination many cases are recognized that otherwise would escape detection, but this does not explain the continuous and marked diminution in the death-rate from diphtheria in the past five years in Boston. A study of the ratio of mortality from any given cause per 10,000 of the living is a much more satisfactory manner of arriving at a definite conclusion regarding the benefits to be derived from any particular line of treatment. The ratio of mortality from diphtheria in Boston per 10,000 of the living from 1893 to 1899 has been compared with that of five European and five American cities. Chart A shows the ratio of deaths from diphtheria per 10,000 of the living in Boston, London, Liverpool, Glasgow, Paris, and Berlin from 1893 to 1899, inclusive. It will be seen from this chart that in 1893 and 1894 Boston had the highest death-rate of any of these cities. Chart B

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CHART B. — Ratio of Mortality of Diphtheria, per 10,000 of the Living, in Boston, New York, Philadelphia, Brooklyn, Chicago and St. Louis, 1893 to 1899.

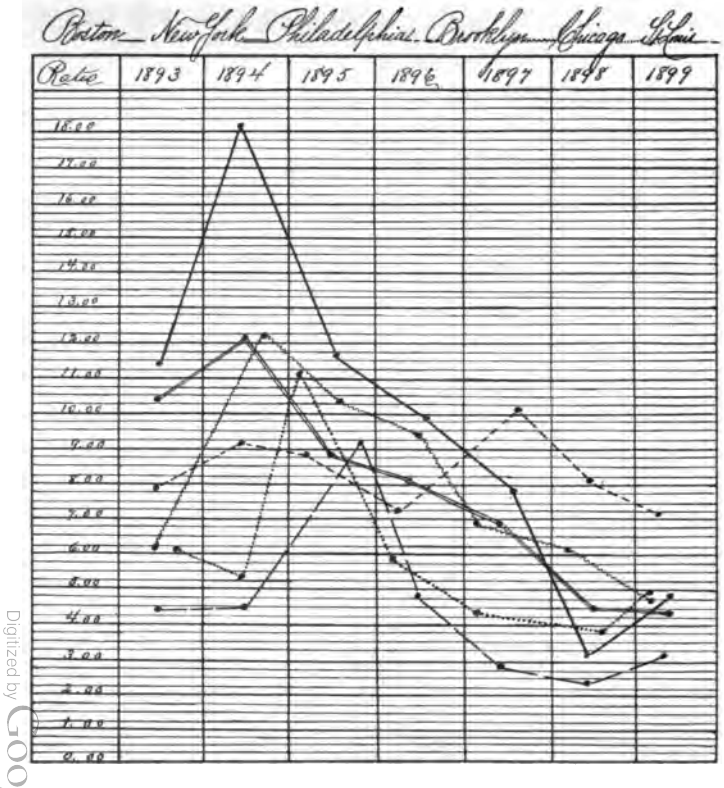
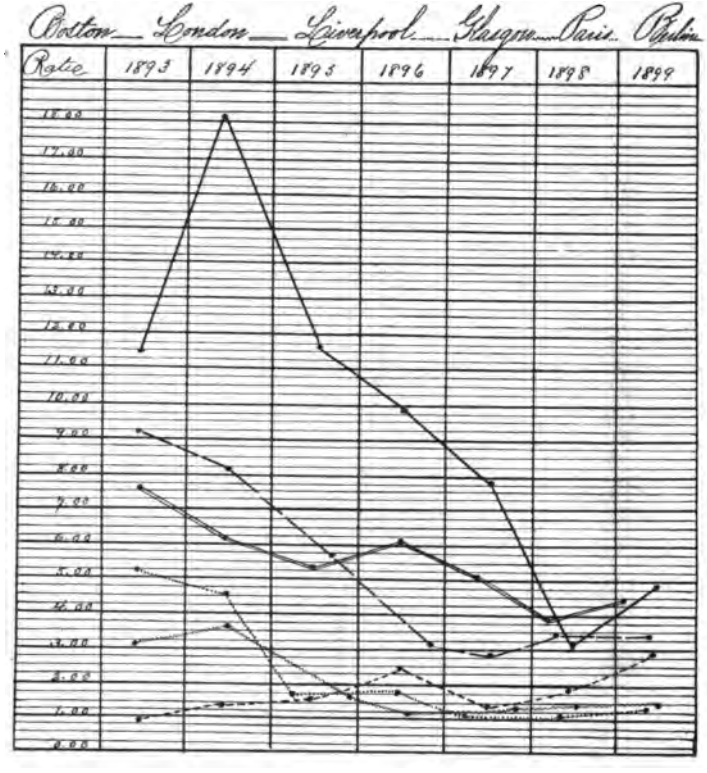


CHART A. — Rato of Mortality of Diphtheria, per 10,000 of the Living in Boston, London, Liverpool, Glasgow, Paris and Berlin, 1893 to 1899.



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shows the ratio of mortality from diphtheria in five American cities taken for comparison with Boston, namely, New York, Philadelphia, Brooklyn, Chicago, and St. Louis. It will be seen from this chart that in none of the other American cities has there been the marked and continuous diminution that has occurred in Boston. This reduction commenced in 1895, in the latter half of which year the South Department was opened and antitoxin was given to each and every patient at the hospital ill with diphtheria. A diminution from 18 per 10,000 to 4.99 in five years cannot be attributed to good fortune, nor to the mild types of the disease. This diminution can only be explained by the use of antitoxin and treatment in hospital. It must be borne in mind that previous to 1895 only about 10 per cent. of the reported cases were treated in hospital, while in 1896, 1897, 1898, and 1899, about 50 per cent. had hospital treatment. In none of the five American cities taken for comparison has the percentage of reported cases treated in hospital been so large as in Boston. In London, the percentage of cases of diphtheria treated in hospital was, in 1898, 56.88; while in Boston for the same year it was 50. In Glasgow, in 1898, 60 per cent. of the reported cases of diphtheria were treated in hospital.

The fact is evident to the intelligent observer that diphtheria in Boston has been extremely prevalent, and that it has been a very important factor in increasing the death-rate. If the number of cases of the disease occurring in Glasgow during 1898, for example, is compared with that in Boston for 1899, it will be seen that in Glasgow, with a population of 724,349 there were 433 cases reported, giving a ratio of morbidity per 10,000 of 5.9, while in Boston, with a population of 550,057, there were 2,836 cases reported; the ratio of morbidity being 51. The ratio of morbidity per 10,000 for London for 1898 was 25.62. In New York City (Boroughs of Manhattan and Bronx) for 1898 and 1899, it was 37.06 and 38.77, respectively. The morbidity ratio per 10,000 in Boston has fallen from 81.00 in 1895 to 51.00 in 1899. A comparison of the morbidity ratios previous to 1894 with those of the succeeding years cannot be made, as there were no general bacteriological examinations previous to 1894.

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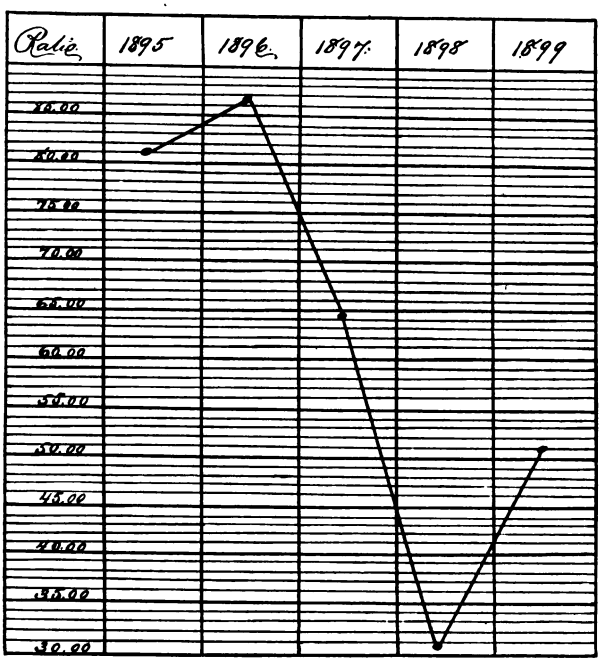
Chart C shows the ratio of morbidity in Boston, per 10,000 of the living for five years, 1895 to 1899, inclusive. It will be seen from this chart that there has been a reduction in the morbidity ratio of diphtheria since the opening of a special hospital for the treatment of this disease. For instance, compare 1895, an epidemic year, with a ratio of morbidity of 81, a ratio of mortality per 10,000 of 11.73, and a percentage of

CHART C. — Ratio of Morbidity of Diphtheria, per 10,000 of the Living, in Boston for Five Years, 1895 to 1899, inclusive.



mortality to the number of cases of 14.48, with 1899, also an epidemic year, with a ratio of morbidity of 51, a ratio of mortality per 10,000 of the living of 4.99, and a case percentage of mortality of 9.76.

Before the advent of antitoxin the death-rate of diphtheria varied from 30 to 50 per cent. In the table prepared by Lennox Browne in his work on diphtheria the per cent. in 11,598 cases treated in the Asylums' Board Hospitals, London, from 1888 to 1894, inclusive, was 30.3. In the Boston

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City Hospital the rate previous to 1895 was 46. Other hospitals give mortality rates of 40 and 50 per cent. In Bayeux's comprehensive work on diphtheria the death-rate is given as 55 per cent. before antitoxin, and 16 per cent. since the advent of this agent. The rate of 16 per cent. is based upon an analysis of more than 200,000 cases. Bayeux in

CHART D. — Percentage of Mortality of Diphtheria, according to Age, in the Asylums' Board Hospitals, London, 1888-1894, Antitoxin not used; in the Asylums' Board Hospitals, London, 1895-1898, Antitoxin used; in the South Department, Boston City Hospital, 1895-1899, Antitoxin used.

his work also makes the statement that not a single death has been scientifically demonstrated to be due to the use of the serum. In the five years that the South Department has been in operation, August 31, 1895, to August 31, 1900, during which time 7,657 patients were treated, the percentage of mortality was 12.9. It must be borne in mind that these were all cases of diphtheria, both from a clinical and from a bacteriological point of view. The death-rate of diphtheria in young children has always been very high, as high as 76

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per cent.; elderly people generally succumb to the disease. A comparison of mortality rates in the Asylums' Board Hospitals in the years 1888 to 1894, during which time 11,598 patients were treated without antitoxin; the same hospitals from 1895 to 1898, when 20,382 patients were treated with antitoxin, with that of the South Department from August 31, 1895, to August 31, 1900, when 7,657 patients were treated with antitoxin in large doses, may be of interest. The death-rate in the London hospitals before antitoxin was used was 30.3; in the same hospitals with antitoxin, 18.4; while that of the South Department was 12.9. Chart D shows the per cent. of mortality by age, of diphtheria in the Asylums' Board Hospitals, London, before antitoxin was generally used; the percentage of mortality in the same hospitals from 1895 to 1898, when antitoxin was generally used, and the mortality percentage from diphtheria in the South Department for five years, when antitoxin was given to each patient ill with diphtheria. A study of this chart shows that in the London hospitals, before antitoxin was used, the mortality percentage in children under one year of age was 61.8; that in the London hospitals, when antitoxin was used, the rate was 38.0 per cent.; that in the South Department the rate was 34.6. In children from 1 to 5 years the percentage in the London hospitals before antitoxin was 49.33; that in the London hospitals, when antitoxin was used, it was 26.83; at the South Department the rate was 17.8 per cent. From 5 to 10 years the percentage was 28.1 before antitoxin, 16.3 with antitoxin; 8.1 at the South Department. It is of interest to note that the rate in patients from 5 to 10 years of age at the South Department is lower by one-half than in the London hospitals. In the other ages the difference is not so marked, but in each instance the rate of the South Department is lower than that of the London hospitals. Lest it should be said that a large number of cases is compared with a smaller number of cases to the manifest advantage of the latter, Chart E has been prepared, which gives the percentage of mortality by age for one year in the following hospitals; namely, South Department, Boston City Hospital; Municipal Hospital, Philadelphia; Belvidere Hospital, Glasgow;

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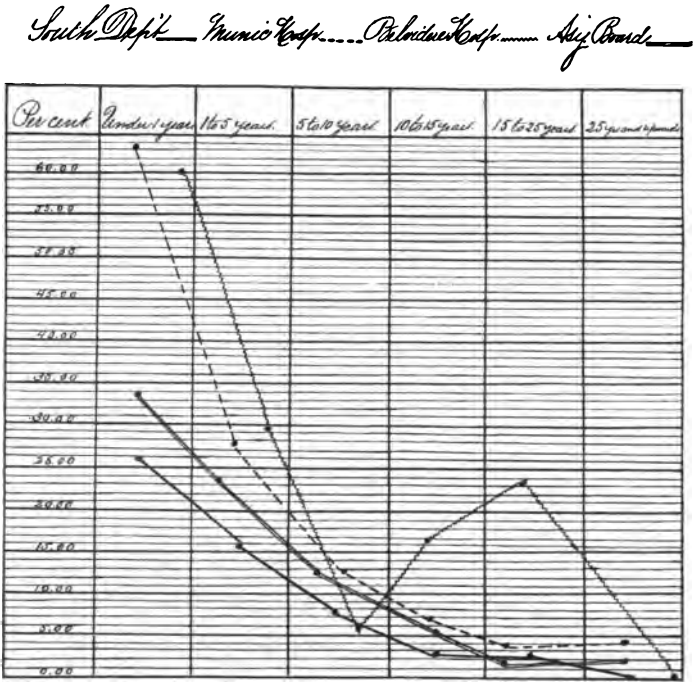
and Asylums' Board Hospitals, London. By following the full black line it will be seen that the rate at the South Department is generally lower than that of the other hospitals taken for comparison. For instance, compare the hospital in Philadelphia with a percentage of mortality of 63 in children under one year of age with that of the South Department with a percentage of 26. There is also a marked diminution

CHART E. — Percentage of Mortality of Diphtheria, according to Age, at the South Department, Boston City Hospital, 1899; Municipal Hospital, Philadelphia, 1899; Belvidere Hospital, Glasgow, 1898, and Asylums' Board Hospitals, London, 1898.



in children from 1 to 5 years of age in favor of the South Department. In the epoch of life from 15 to 25 years the difference between the percentage of mortality in the Glasgow hospital as compared with the Boston hospitals is very marked. It is a very significant fact that in 1899 the cases of diphtheria were of an extremely virulent type, and therefore that much larger doses of antitoxin were required than in some of the previous years, and yet the death-rate was

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lower generally than in any of the hospitals taken for comparison.

It is generally conceded that laryngeal diphtheria is a very serious disease, and that in operative cases, intubation and tracheotomy, the death-rate is very high, being in pre-antitoxin days from 75 to 87 per cent. Since antitoxin has been in use the death-rate has fallen very materially. In 313 cases of tracheotomy in the Asylums' Board Hospitals of London, the per cent. was 38.0. In the Belvidere Fever Hospital, Glasgow, the operative cases for the year ending May 31, 1899, had a percentage of 41.9. In the Willard Parker Hospital, New York City, according to Dr. W. H. Park, there were 737 cases of intubation treated from 1895 to February, 1900, with a per cent. of mortality of 63. In the last two years the rate was 52 per cent. In the Municipal Hospital of Philadelphia the rate in 165 cases was 58.78 per cent. At the South Department, during 1899, there were 192 intubation cases treated, the per cent. of mortality being 34, as compared with a percentage of mortality of 46 in 1898. This reduction must be attributed to the large doses of serum given in the severer cases when there was an indication that the membrane was extending into the bronchi.

It has been shown by the foregoing figures that the ratio of mortality of diphtheria per 10,000 of the living has been diminished in a marked degree in Boston since the introduction of antitoxin; that there has also been a marked reduction in the mortality per cent. in the operative cases since larger doses of the healing serum have been given. No hard and firm rule can be made regarding the use of the serum; the agent must be given until the characteristic effect is produced on the diphtheritic membrane; in some cases 4,000 units will accomplish this, in other instances 60,000 or 70,000 units may be required. When a guinea-pig is inoculated at the laboratory with a certain definite amount of the toxin of diphtheria it is a very easy matter to antagonize this with a certain amount of antitoxin. In the case of a patient ill with diphtheria there is no way of estimating the quantity of toxin generated by the membrane and therefore one must administer the agent until the characteristic effect is produced,

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viz.: the shrivelling of the membrane; the diminution of the nasal discharge; the correction of the fœtid odor and a general improvement in the condition of the patient. In the operative cases the beneficial effect of large doses of antitoxin has been marked, preventing, in many instances, the extension of membrane to the smaller ramifications of the bronchi; a most important factor in raising the death-rate in this class of cases. In the operative cases it is safe to say that nearly twenty per cent. of the deaths was caused by blocking of the bronchi with diphtheritic membrane. At the South Department the autopsies proved this fact. It was observed in pre-antitoxin days that patients in operative cases would do well for from twenty-four to forty-eight hours after the operation, and then would commence to have a limited amount of dyspnœa; the temperature would rise; the tube would become clogged with a thick, tough tenacious mucus; the physical sign in the lungs would be that of a bronchopneumonia; and the patient would succumb in a short time. This clogging of the tube with hard muco-purulent discharge is an indication of extension of membrane; a sympton of very serious import, and demands the heroic administration of antitoxin. No case of diphtheria in the acute stage should be considered hopeless. Antitoxin should be administered in each and every instance. It has been my experience during the past few years to see so many patients apparently hopelessly ill, recover, that my convictions are very firm on this subject. When one sees a patient with membrane covering the tonsils and uvula; profuse sanious discharge from the nose, spots of ecchymosis on the body and extremities; cold clammy hands and feet; a feeble pulse; and the nauseous odor of diphtheria, and finds that after the administration of 10,000 units of antitoxin in two doses the condition of the patient improves slightly; that after 10,000 units more have been given there is a marked abatement in the severity of the symptons; that when an additional 10,000 units have been given the patient is apparently out of danger, and eventually recovers, one must believe in the curative power of antitoxin. When one sees a patient in whom the intubation tube has been repeatedly clogged; when the hopeless condition of the

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patient changes for the better after the administration of 50,000 units, one cannot help but be convinced of the importance of giving large doses of antitoxin in the very severe and apparently hopeless cases. In the majority of instances these large doses are not required, particularly if the patients are seen early in the attack; 4,000 to 6,000 units being enough to produce the characteristic effect on the membrane. As illustrating the advantage of the early administration of antitoxin, an allusion to the cases of diphtheria occurring in the staff of the South Department may be of interest. There have been since September, 1895, 104 instances of diphtheria contracted in the line of duty, and not a single death. Each patient received a full dose of antitoxin, 4,000 units at the outset, or as soon as there were any symptoms of the disease. In some instances it was not necessary to repeat the dose; in others the doses were repeated two or three times. It is of interest to note that in this series of cases there were no marked symptoms of paralysis; that heart complications did not occur, and that the duration of the illness was comparatively short. It must be borne in mind that these were genuine cases of diphtheria, contracted under unfavorable conditions. The results obtained with cases of diphtheria injected with antitoxin by the Health Department of New York City also prove the advantage of the early administration of the serum. Dr. Park gives the following figures: Of 319 patients injected on the first day of the illness, 13 died, a mortality of 4 per cent.; 850 were injected on the second day, 57 died, a mortality of 6.7 per cent.; 573 were injected on the third day, with a mortality of 12 per cent.

In the study of any particular line of treatment for a special disease the clinical picture presented by patients ill with that disease is always of interest, and is frequently more conclusive than a simple array of figures. A short history of a few of the extremely severe cases of diphtheria in which antitoxin was administered in large doses will be given.

Case 1. — A boy, six years of age. When admitted he had been ill three days; there was a large patch of membrane on each tonsil; the uvula was œdematous; there was a profuse nasal discharge. Dyspnoea was very great, and there was marked cyanosis. The cul-

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tures were positive. Pulse feeble and rapid. Temperature, 99.5. There was a slight trace of albumin in the urine. He was intubed at once, and given 4,000 units of antitoxin. The intubation tube not giving relief, it was removed in ten minutes, when the patient expectorated a quantity of thick tough tenacious mucus, and the breathing immediately became easier. On the second day after admission the dyspnoea was urgent, and the boy was re-intubed with marked relief. In four days this patient had 56,000 units of antitoxin without any injurious effect and with positive relief. He was discharged well. He had none of the usual sequelæ of diphtheria. He did have a troublesome urticaria. The heart did not at any time have an irregular action; there was no indication of paralysis.

Case 2. — A girl, six years old. She had been ill three days when admitted. The tonsils and uvula were covered with a thick membrane. Pulse rapid and weak. The membrane commenced to disappear in three days, but on the fourth it commenced to re-form and therefore large doses of antitoxin were given. In all, this patient received 80,000 units of antitoxin. The cervical glands suppurated. At one time during the course of the attack the action of the heart was irregular. There was a slight palatal paralysis. At one time there was a slight trace of albumin in the urine. She made a good recovery.

Case 3. — A man, eighteen years old. He had been ill one week at the time of admission. There was great prostration; a profuse nasal discharge with a foul odor; there was a very extensive membrane covering the tonsils, uvula and palate. The action of the heart was feeble; the sounds indistinct. Pulse, feeble. The general condition indicated speedy death. He had on entrance an initial dose of 6,000 units of antitoxin, repeated in five hours. The next day he had four doses of 6,000 units each, and on the third and fourth days a like quantity. On the fifth day after entrance the throat was clear, and the mucous membrane normal in appearance. For the first four days delirium was a marked symptom. The patient was unable to swallow, and food and stimulants were given by the rectum. At one time there was a slightly nasal voice, but there was no marked paralysis. The action of the heart was regular at the time of discharge. A slight trace of albumin was found in the urine. Urticaria was an annoying complication, but not a grave one. There was no arthralgia. Brandy and strychnia were given in large doses. It is cases of this class that swell the mortality ratio of hospitals. The patient was moribund when admitted; he left the hospital well, and has been well up to the present time. It is possible that the man might have recovered with a slightly diminished dose; it is certain that the usual doses of antitoxin would not have saved his life, and it is also certain that no injurious effect followed the large dose.

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Case 4. — A colored boy, seven years old. On admission this patient had a very weak pulse ; the heart sounds were feeble ; the tonsils, uvula and hard palate were covered with a dirty necrotic membrane ; there was a profuse nasal discharge ; the cervical glands on the right side had sloughed ; there was an intolerable odor. His condition was as unfavorable as it could well be. The boy had 84,000 units of antitoxin in five days. He was discharged well in sixty-six days. At the end of the sixth day after entrance the condition of the patient had improved so much that no one who had not seen him on entrance would have believed that he had been so critically ill. He made a good recovery, which was somewhat delayed by post-diphtheritic paralysis. He was nourished during part of the time by the rectum. At one time during convalescence he had one-eighth of one per cent. of albumin in the urine. This albuminuria could not, however, be attributed to the antitoxin, as it is one of the most frequent symptoms in severe attacks of diphtheria, and was recognized and described long before the days of antitoxin.

Case 5. — A boy, age eight years. On entrance there was profound prostration; very extensive membrane in the throat, a marked dyspnoea ; feeble and irregular action of the heart. This certainly could not be called a mild attack of the disease. This patient had 56,000 units of antitoxin. He made a good recovery. He did not have paralysis. There was an eruption of urticaria of moderate severity. A slight trace of albumin was found in the urine.

Case 6. — A woman, aged twenty-four years. When seen, the patient had been ill five days. There was a profuse fœtid nasal discharge; extensive diphtheritic membrane in the fauces; marked prostration; a weak and irregular pulse; a dilated heart, feeble in action; the sallow hue of the skin seen in toxæmia. This patient had 76,000 units of antitoxin in four days. On the fifth day after entrance the membrane had disappeared from the throat, and her general condition had very much improved. In the case of this patient the irregular action of the heart continued for some little time. She, however, was discharged well at the end of fifty-four days. The somewhat prolonged stay in the hospital was due to the condition of the heart, and a slight paralysis of the muscles of deglutition. Urticaria was not a distressing symptom in this case. Arthralgia was not present. A slight trace of albumin was found in the urine for three or four days during the period of convalescence.

Case 7. — A girl, eleven years of age. This patient had been ill two days when admitted. Her condition was as follows: Marked prostration; profuse nasal discharge; extensive membrane on the tonsils and uvula; a strong fœtid odor; the action of the heart was irregular, and the sounds indistinct. In four days she received 52,000 units of antitoxin. Urticaria and arthralgia caused some

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considerable discomfort. No paralysis developed. The patient was discharged well in thirty-nine days. From the rapid spread of the membrane in the two days before admission to the hospital it is evident that this was an extremely virulent attack of diphtheria. The conclusion that the girl would have died if antitoxin had not been given in large doses is justifiable.

Case 8. — A man, eighteen years of age. He had been ill three days before admission, with sore throat, headache and vomiting. When seen there was considerable prostration, a profuse nasal discharge, marked enlargement of the cervical glands; hypertrophied tonsils covered with a thick membrane; an extremely fœtid odor to the breath. The action of the heart was regular, but somewhat weak. This patient had 50,000 units of antitoxin in four days. The throat cleared in three days, but as the nasal discharge continued, two additional doses of antitoxin were given. The man made a good recovery, and was discharged in thirty-five days. Urticaria and arthralgia did not cause much discomfort in this case. The patient did not have paralysis. Albuminuria was a transient symptom. In this case, if the toxin of diphtheria had not been antagonized by large doses of antitoxin, judging by experience, paralysis would have been a very prominent symptom. Six months after leaving the hospital this man was well.

Case 9. — A man, nineteen years of age. He had been ill three days when admitted. On examination, the following condition was found; enlarged cervical glands with great tenderness; a profuse nasal discharge; tonsils greatly enlarged, meeting in the median line, and covered with thick diphtheritic membrane; uvula covered with membrane; profound prostration. Prognosis unfavorable. This patient had 90,000 units of antitoxin in five days. The throat cleared in three days; the nasal discharge diminished; the offensive odor of the breath was not so marked. The patient was discharged well in thirty days. Albuminuria was not pronounced. There were no complications of serious import due to the use of antitoxin. Urticaria and arthralgia, although present, did not cause a great amount of discomfort.

Case 10. — A man, aged thirty-four years. He had been ill four days when admitted. There was very extensive diphtheritic membrane on each tonsil; the uvula was covered; there was a profuse nasal discharge; the cervical glands were much enlarged; there was marked prostration; the pulse was feeble and irregular; there was some dyspnœa; the voice was husky. The clinical picture he presented was that of a patient moribund from an attack of diphtheria. The condition of the man seemed absolutely hopeless, but acting on the principle that no person ill with diphtheria should be considered beyond help, 8,000 units of antitoxin were given; a second dose of 4,000 units was given in three hours and repeated every four or six

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hours until 92,000 units had been administered. In four days there was a marked improvement in the condition of the man. In five days the throat was clear of membrane. He made a good recovery, was discharged well in twenty-six days. He, however, had post-diphtheritic paralysis about three weeks after his discharge. Recovery from this, however, has been complete, and at the present time, 130 days after the commencement of the attack of diphtheria, this patient is well; therefore, the statement cannot be made with truth that he has suffered any ill effects from the large dose of antitoxin.

Case 11. — A woman, whose age was forty-eight years. She had been ill five days. On entrance, the tonsils, posterior pharyngeal wall, uvula and soft palate were covered with a thick diphtheritic membrane. There was also a patch of membrane on the lower lip. The cervical glands were enlarged. The patient was aphonic; there were frequent attacks of dyspnœa, so that at one time operative interference was imminent. She was unable to swallow, and was therefore nourished by the rectum. The prostration was profound. In five days 48,000 units of antitoxin were given; 12,000 units being administered the first day. At the end of the fifth day the throat was practically clear, the general condition of the patient much improved. The cervical glands suppurated. For two or three days the slightest possible trace of albumin was found in the urine. Urticaria and arthralgia caused a certain amount of annoyance. There was no special heart complication, although at one time the action of the organ was irregular, as is always the case in severe attacks of diphtheria. Post-diphtheritic paralysis ensued, but was not sufficient at any time to cause great anxiety. This certainly cannot be considered a mild attack of the disease. If a less amount of antitoxin had been given the patient would have died, without doubt. It is of interest to note that four other members of this family had diphtheria, but as antitoxin was given early in the course of the disease, only small doses were required. This woman had a tedious convalescence, but was discharged well. Seven months from the date of the attack she was in good health.

Many more cases might be cited in which large doses of antitoxin were given with satisfactory results, but enough has been said to prove that small doses of antitoxin are of little avail in the treatment of grave types of the disease; that in order to obtain the best results the serum must be heroically administered. It is true that all of the patients to whom large doses of antitoxin have been given have not recovered, but so many of them have that one must be convinced that

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large doses are imperatively demanded in very severe cases. When death has occurred, it has been from nerve degeneration or from sepsis. In no instance was there any injurious effect produced by either the large or small doses of antitoxin. Albuminuria, although present in may cases, cannot be attributed to the serum, as albuminuria is one of the most frequent symptoms in diphtheria. Heart complications of a serious nature have not been so frequent in the 7,657 patients treated at the South Department, as would have been the case in a like number treated without antitoxin. Paralysis, although occurring in the severer cases, has not been so prominent as it would have been in an equal number of cases treated without antitoxin. Urticaria and arthralgia are certainly very annoying complications, but they do not imperil the life of the patient, and are therefore not worthy of being considered an argument against the use of the serum. It has been observed that the serum from certain horses caused a larger per cent. of urticaria than that from others. There is no explanation of this fact. It is to be hoped that in the future there may be some way of eliminating this troublesome symptom. The time in which an urticaria may appear varies from ten minutes after the injection of antitoxin to three weeks. Abscesses after the injection should be of rare occurrence, and when they do appear are an indication of some error of technique in the sterilization of the syringe or in the quality of the serum. In the last 1,500 injections given at the South Department an abscess occurred twice.

It must be conceded that diphtheria at the outset is a local disease caused by the bacillus of diphtheria. The constitutional symptoms are the result of the extension of membrane and the formation of toxin. If the local process can be stopped, if the membrane can be prevented from extending, the life of the patient will be saved. Although different remedies were used to prevent the extension of membrane before the advent of antitoxin the death-rate from diphtheria remained about the same until the introduction of antitoxin. Before the days of antitoxin there was no method of limiting

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the extension of the membrane. It is true that the membrane could be torn off, leaving a raw surface, but the organism of diphtheria would not be destroyed, and therefore the membrane would re-form. The number of different applications to the diphtheritic membrane was so great as to prove that no one of them was satisfactory. No germicide can be of sufficient strength to effectually destroy the bacilli of diphtheria without causing destruction of the mucous membrane, and thus opening a fresh field for the growth of the organism. In the light of our present knowledge regarding the etiology of diphtheria, there can be no more unscientific method of treating the disease than by the application of caustics to the membrane, with the hope of destroying it. The experiments of Roux and Yersin proved conclusively that the bacilli of diphtheria would not grow on intact mucous membrane, and, therefore, the less the throat of a patient ill with diphtheria is abraded the better.

Of the 7,657 cases of diphtheria treated in the five years that the South Department has been open, 772, or 10.08 per cent., required operative interference. In about one hundred instances there were marked laryngeal symptoms, but operative interference was not required, the stenosis being relieved by antitoxin. The use of steam for the relief of the stenosis has been discarded, except in cases of tracheotomy, because it was found that the relief was not sufficient to offset the debilitating effects of the steam on the patients. The sublimation of calomel was tried in many cases, but without satisfactory results, as the patients almost invariably required operation. To discuss the relative advantages of intubation as compared with tracheotomy, would prolong this paper to an unseemly length, but a death-rate of 34 per cent. in intubation cases as compared with the death-rate reported in tracheotomy cases shows conclusively the advantage of intubation over tracheotomy.

From a comparison of the health reports of Boston, before and after the introduction of the anti-diphtheritic serum, from a comparison of the health reports of other cities, from a study of hospital reports, from a clinical observation of

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nearly 8,000 cases of diphtheria, the following conclusions are justifiable:

1st. That the ratio of mortality of diphtheria, per 10,000 of the living, was very high in Boston previous to 1895.

2d. That the ratio of mortality per 10,000 has been very materially reduced since the introduction of antitoxin.

3d. That the percentage of mortality in the South Department is lower than that of any of the hospitals taken for comparison.

4th. That since larger doses of antitoxin have been given the death-rate has been materially reduced, this reduction having occurred in the apparently moribund cases.

5th. That no injurious effect has followed the use of the serum.

6th. That to arrive at the most satisfactory results in the treatment of diphtheria, antitoxin should be given at the earliest possible moment in the course of the disease.

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III.

ACUTE HEMORRHAGIC PANCREATITIS; ITS SURGICAL TREATMENT; WITH REPORT OF SIX CASES.

By F. B. Lund, M.D.

During the little more than a decade which has elapsed since Fitz, in his classical monograph on Pancreatitis (Middleton Goldsmith Lecture for 1889),[1] first adequately described the disease and classified its various manifestations into three forms, the hemorrhagic, the suppurative and the gangrenous types, considerable attention has been devoted to it, both by clinicians and pathologists. Many interesting results have been attained by their assiduous labors, which will be but briefly noticed here, as it is the surgical aspects of the disease which the writer desires especially to consider. The deep situation of the pancreas in the abdomen, and its close anatomical relations to important organs of digestion and assimilation, and the main trunks of their arterial, venous and nervous supply, render its acute inflammatory affections of especial interest and proportionate difficulty, both from the point of view of medicine and surgery. From a medical standpoint the treatment of its acute inflammatory conditions can only be supportive and symptomatic. The possibilities and limitations of the surgical treatment of these affections it is the object of this paper to attempt to illustrate, as far as possible, by six cases taken from the personal experience of the writer, and of Drs. John C. Munro and W. P. Bolles, who have kindly placed four cases at the writer's disposal.

Case I., of Dr. J. C. Munro, was successfully operated upon in his private practice. As but four previous cases of

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recovery after operation have been recorded this case is of particular interest and value.

Case II., operated upon by the writer, in which the operation was performed as an emergency in the presence of signs of pneumonia, at the base of the left lung, and in which the patient lived eight weeks, coming successfully through a pneumonia, and finally succumbing to hemorrhage from an intestinal ulcer, also presents many points of interest concerning the surgical treatment of this disease.

Ten years ago Dr. Fitz saw the surgeon's opportunity in these cases in the drainage of the parapancreatic abscess which follows the hemorrhagic process, and is often associated with necrosis of the pancreas. A review of Cases I. and II., which were both operated upon in the presence of a tumor consisting of blood clot and necrotic fat, on account of the progressive increase in the severity of the symptoms, would indicate that if lives are to be saved in the more severe forms of the disease it will be too late to wait for necrosis and sequestration of the pancreas with abscess before operating.

Case IV. is here in point. In this case, two weeks after the onset of the disease, the entire pancreas was necrotic, and areas of fat necrosis extended throughout the abdomen. Another argument in favor of early operation is the impossibility of absolute diagnosis. The surgeon is confronted with an acute epigastric peritonitis. It is not impossible in more or less typical cases to make a diagnosis, but in other cases it will be impossible, absolutely, to exclude perforating gastric ulcer, perforation of a gall duct, or duodenal ulcer. The presence of tumor some time after either of these conditions may be explained by the formation of a localized abscess in the lesser peritoneal cavity. It is impossible to exclude perforating gastric ulcer on account of the absence of a history of hematemesis, as was suggested by Dr. Fitz in his paper, for we now know that many cases of gastric ulcer have gone on to perforation without ever presenting the symptom of hematemesis, local tenderness, or any other symptom on which an absolute diagnosis could be made. These conditions present emergencies, requiring immediate

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operation, delay involving spreading of peritonitis, burrowing of pus in the retroperitoneal space and other grave accidents, so that unless they can be excluded, exploration is imperative. If, therefore, we can show that in the alternative of acute pancreatitis with hemorrhage and fat necrosis, operation is also imperative, we have established the advisability of operating upon all cases of acute epigastric peritonitis not attended by such marked shock as to render the operation dangerous to life. In Case II. the patient's general condition and the presence of a beginning pneumonia in the left lung rendered the question of operation a very serious one, and indicated the employment of local anesthesia, if possible. Yet in this case a rapid clearing out and packing of the cavity with gauze gave the patient immediate comfort, and distinctly benefited her condition for four days. Then she successfully went through a pneumonia, lived eight weeks after the operation, and in case the abscess had pointed, as it commonly does, in the lumbar region, and not perforated the diaphragm, would probably have been successfully drained and cured.

It must not be lost sight of that probably many mild cases of pancreatitis or peri-pancreatitis attended by less degrees of hemorrhage and by fat necrosis recover spontaneously by absorption and perhaps cicatrization. In the cases which have been reported as successfully operated upon by Osler[2] and Manges,[3] the operation consisted in simply opening the abdomen, making a diagnosis of the presence of hemorrhage and fat necrosis and sewing the abdomen up tight. If either of these cases, as did the case of Thayer and Finney or Cases I. and II. of this paper, gone on to necrosis and sequestration of portions of the pancreas, and abscess formation, it is fair to assume that the history would have been different, and that further operation for evacuation and drainage of the abscesses would have been necessary to save life. It seems probable that the cases which go on to gangrene of the whole or part of the pancreas and parapancreatic abscess are those which may be classed as of the second grade of severity; the most severe cases proving immediately fatal from hemorrhage and shock, those of the second

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grade, marked by severe symptoms at first, but going on to parapancreatic abscess and gangrene of the pancreas, and the milder cases recovering.

The symptoms of pancreatitis are described by Fitz as consisting of "sudden, severe, often intense, epigastric pain without obvious cause, in most instances followed by nausea, vomiting, sensitiveness and tympanitic swelling of the epigastrium. There are prostration, often extreme, frequent collapse, low fever, and a feeble pulse. Obstinate constipation is the rule, but diarrhœa sometimes occurs. If the case does not end fatally in a few days, recovery is possible, or the recurrence of the symptoms in a milder form takes place, and the characteristics of sub-acute peritonitis are developed." The presence of the tumor in the epigastrium was noted in four of the cases reported in this paper, though in most of them the presence of the stomach or intestine in front of the tumor rendered it tympanitic on percussion. In case II. the tumor, consisting of blood clot and necrotic tissue, presented against the anterior abdominal wall.

Aetiology and Pathology. — Acute pancreatitis has been considered rare in women, and of forty-one cases collected by Körte[5] in 1898, only four were women. Of the six cases reported in this paper, five were women. Three of the five women were extremely fat. In none was a history of alcoholic excess obtained. The ages ranged from thirty to fifty years. The presence of gall stones in the gall bladder and ducts was noted in four of the cases. In these cases it is impossible to say whether the previous attacks of epigastric pain and vomiting were due to milder attacks of pancreatitis or to gall stones. The presence of gall stones in a considerable number of cases of pancreatitis points to obstruction of the duct of Wirsung or abrasion of the walls of the ductus communis choledochus, with possible infection of the head of the pancreas, by which the duct is practically surrounded along the lower part of its course, as possible causes of the disease.

The presence of fat necrosis was noted in all the cases. The relation of fat necrosis to pancreatic hemorrhage and inflammation have been the subject of a great deal of study

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of late years. The most notable recent contributions to our knowledge of this process are those published by Flexner[6] and Williams.[7] Flexner regards the fat necroses as the effect of the fat splitting ferment of the pancreatic fluid, which in some way escapes from the duct into the surrounding tissues. The fat tissues immediately surrounding the pancreas are at first affected, but in acute or long-continued cases the process may extend all over the abdomen, or even to the pericardial fat. Fat necroses are not found in all cases of acute pancreatic disease, and have been noted during laparotomies for various abdominal conditions where no evidence of pancreatitis was found, but they are present in the vast majority of cases of acute pancreatic disease, and their presence is generally considered pathognomonic. They accompany especially the hemorrhagic form of the disease, and Flexner, in his experimental work, found disintegration of pancreatic tissue to be one of the results of free hemorrhage. He regards the necrosis of the fat tissue, as well as of the pancreatic tissue, as results of the escape of pancreatic secretion, due in its turn to the degeneration resulting from hemorrhage. Hemorrhage is to be regarded as one of the effects of inflammation of the gland, and when excessive, both in clinical and experimental cases, dominates the process. The necrosis of fat and pancreatic tissue resulting from the hemorrhage may in time form foci for the action of micro-organisms and still further spread the process. The entrance of the micro-organisms responsible for the primary inflammation and hemorrhage probably takes place through the ducts.

It cannot be regarded as definitely settled that the escape of pancreatic fluid is always the cause of pancreatitis in the human subject. In Case II. of this paper the autopsy showed a practically normal pancreas, having areas of fat necrosis extending in among the acini from the periphery and no distention, inflammation, or other abnormality of the pancreatic duct or its branches. The pancreas removed after death in Case III. also showed a process apparently extending inward from the periphery, and no discoverable abnormality of the ducts.

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CLINICAL HISTORIES.

A brief account of the six cases upon which this paper is based, and resumé of the points which they illustrate, may well precede the deductions on the surgery of the pancreas, with which the paper will conclude.

Case II. — Summary. Acute Pancreatitis with Fat Necrosis. History of Previous Attacks. Operation one month after onset. Median Laparotomy, and Lumbar Incision for Drainage. Immediate improvement. Second operation for drainage of pus pockets through lumbar incision five weeks later. Recovery.

Clinical History.

[From Notes of Drs. J. C. Munro and Henry Jackson.]

Mrs. S., age thirty-six, was seen by Dr. Henry Jackson, in consultation with Dr. Flanders, on March 4, 1899. As a girl she had various symptoms suggestive of hysteria or a highly neurotic condition. Two years previously she had had three attacks of pain in the epigastrium, running through to the back; this pain she described as boring in character; as accompanied by vomiting, but not by jaundice. Three weeks before she was seen by Dr. Jackson she had had an attack of severe pain in the epigastrium and left hypochondrium, relieved only by morphine, and accompanied by vomiting. No interference with the action of the bowels. The vomiting persisted for one week. She had had moderate fever since the beginning of the attack, and a pulse 90 to 100.

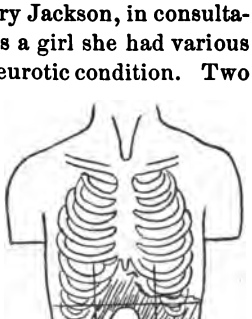

Fig 1.

On March 7 she was seen by Dr. J. C. Munro, from whose notes the following account is abstracted:

Examination showed a very corpulent woman suffering from pain, general abdominal tenderness and spasm, especially marked in both hypochondria and epigastrium. Tumor, as in shaded portion of figure, especially in left renal region and hypochondrium and over gall bladder. Leucocytosis. Pulse, 120. Urine, negative.

Diagnosis: Probable rupture of gall duct with retroperitoneal abscess. Pancreatitis, and possibly abscess or tumor of kidney complicating gall-stones, were considered.

March 8, operation. A long median incision was made through the very thick abdominal walls in the epigastrium. The omentum,

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which was lightly adherent to the abdominal parietes, contained nodules of fat necrosis, which were also noted on the parietal peritoneum. On freeing the omentum the pancreas was found swollen in the median line, and on the left enlarged so as to form a tumor which felt hard and nodular. The finger was pushed into the tumor in various directions, in the hope of finding pus. The patient's condition at this time became alarming; the pulse rose to 180, and she became cyanotic. There was moderate bleeding from the fresh adhesions about the pancreas. An opening was made in the left lumbar region, using the finger as a guide, and the anterior wound closed with deep sutures of silkworm gut. Through the lumbar opening the tumor was broken up by pushing the finger in various directions, and a nodule removed, together with some omentum and fat necrosis. The wound was packed with iodoform gauze around a glass drainage tube, and a baked gauze dressing applied. The patient was in very poor condition at the close of the operation, and was stimulated freely. During the night she rallied somewhat, though vomiting continually. At 10 A.M., on March 9, the vomiting ceased, and the bowels moved. During the next few days the patient's condition steadily improved. On March 12, on removal of the gauze drains, there was a free greenish discharge, with fine fat globules.

On March 20 there was still considerable greenish discharge from the lumbar wound; the anterior wound had healed by first intention. There was no albumen nor sugar in the urine. The patient continued to improve, the wound discharging freely until April 8, one month after the operation, when a rise of temperature to 103° took place, with vomiting and prostration. On the next four days the temperature ran between 101° and 105°, and the patient was nervous, restless, and discouraged. On April 11 tenderness and a tumor were noted in the left renal region. While probing the sinus the probe passed through a thin wall into a cavity, with evacuation of several ounces of sweet, greenish pus of molasses odor, containing particles of broken-down pancreas and fat necrosis.

On April 15, under ether, the sinus was enlarged, and its posterior wall broken through, admitting the finger into several pockets containing greenish, sweet-smelling pus. These pockets reached to the median line, downwards along the posterior abdominal wall for two and a half inches, and upwards along the latter for five and a half inches, passing behind the stomach towards the epigastrium. A counter opening on a level with the floor of the pockets was made posteriorly in the left lumbar region, and drainage with rubber tubes and gauze wicks was provided.

Following this operation there was a very free discharge from the sinuses. Subsequently this discharge became fœcal, and was noted to contain certain particles of food eaten the day before it appeared in the discharge. This discharge ceased in about ten days, and the

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patient steadily improved, and went on to complete recovery, leaving the house for a ride on June 10, 1899. Her health ever since has been excellent.

Remarks.

This case is notable for the absence of pancreatic hemorrhage found at the operation. The location of the tumor and the presence of the fat necrosis, however, establish the diagnosis of pancreatitis. The serious condition of the patient at the primary operation emphasizes the necessity of rapid operating and simple procedures in these cases. The provision for lumbar drainage undoubtedly played a most important part in bringing about ultimate recovery, for the retroperitoneal pus pockets at the second operation were successfully drained through the lumbar incision, and it is difficult to see how this could have been accomplished otherwise, though Thayer's case (*loc. cit.*) recovered after drainage of the abscess through a median epigastric incision. It is probable in the latter case that the pus was confined to the lesser peritoneal cavity, and had not burrowed to any extent in the retroperitoneal space. Körte,[8] in 1899, called attention to the importance of lumbar incision in retroperitoneal pocketing of the pus in necrosis of the pancreas with abscess formation, and describes three cases operated upon through a lumbar incision, with two recoveries. In this case lumbar drainage was provided at the primary operation, owing to the fact that the tumor extended into the left lumbar region, and this provision was later undoubtedly the means of saving the patient after abscess formation. The continued good health of the patient after the operation would show that there had not been sufficient destruction of pancreatic tissue to permanently interfere with its functions.

Case II. — Summary. Acute hemorrhagic pancreatitis. Operation one week after onset. Evacuation through median and right lateral incision of blood and necrotic fat. Relief of symptoms followed by rise of pulse, temperature, and respiration, with cyanosis. Dulness and râles over bases of both lungs. Exploratory incision in left lumbar region. Death eight weeks after operation from hemorrhage from erosion of an artery in wall of splenic flexure. Autopsy.

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Abscess in lesser peritoneal cavity, perforating diaphragm above spleen. No retroperitoneal or lumbar pockets. Perforating ulcer of splenic flexure of colon, with hemorrhage from an eroded artery. Perforating ulcer of jejunum.

Clinical History.

[Abstract from Hospital Record.]

N. G., thirty, single, dressmaker, entered the City Hospital July 26, 1900. Service of Dr. H. W. Cushing. Three years ago had "indigestion" for about a year, followed by attack like present, but less severe; associated with abdominal pain, running into left shoulder; fever; vomiting. No jaundice; bowels regular; sick in bed two weeks. Has been well since. Gaining in weight. One week ago woke up with abdominal pain and vomiting. Says she was not feverish. No chill then or since. Pain was crampy, and not localized. Vomitus bitter; no blood. Bowels moved with enemata and laxatives; dejecta just after onset were very light colored; since then dark; no blood noted. Vomited day after onset, but not since. Two days after onset, abdomen was distended and tender. Urine has been high-colored, never bloody. Since onset there has been shortness of breath, and deep breath has been painful. No cough or expectoration. Pain has remained about the same since onset; some pain in left shoulder.

Physical Examination. — Corpulent. Pupils equal and react. Scleræ yellow. Tongue fairly clean. T., 100.8; P., 128; R., 40. Heart's action somewhat irregular. Aortic second sound occasionally reduplicates. The first pulmonic is replaced by a soft murmur; pulmonic second not accented.

Lungs. — Fine moist râles in right back and axilla. On left back, near angle of scapula, there is dulness, diminished broncho-visicular respiration; increased voice sounds; fine crackling râles.

Liver. — Dulness begins at fifth space.

Abdomen. — There is muscular spasm and tenderness in the upper abdomen, especially on left. A firm, smooth, resistant mass is felt occupying the epigastrium, mostly to the right of the median line and extending down to level of umbilicus, where edge of mass is apparently felt. Percussion note is tympanitic over this mass.

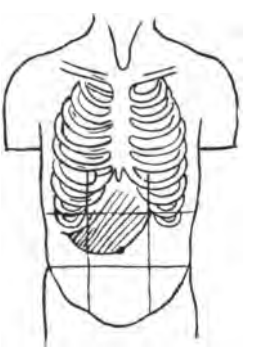

Fig 2.

There is slight distention. No free fluid could be demonstrated. No tenderness in lower abdomen. There is slight pitting of the ankles.

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July 27. — Seen in consultation by Drs. Post and Jackson, who advise operation at once. The diagnosis was an abscess or inflammatory tumor in epigastrium, due to pancreatitis or localized abscess from perforating gastric ulcer.

Operation, by the writer, under local anæsthesia with 1–1000 cocaine solution. Incision 5 in. long, median line above umbilicus. On entering the abdomen a tumor was felt just to the right of the median line, adherent by light fresh adhesions to the abdominal wall. Tumor could be felt to fluctuate. The patient was then etherized to the primary stage, and a second incision made just outside the outer border of the right rectus muscle. Finger was passed into the centre of the tumor, which was found to consist of necrotic tissue and blood clot. A considerable amount of blood clot was scooped out, and the cavity freely irrigated from one incision to the other. The finger reached the region of the pancreas. Gauze packing was attempted, but profuse hemorrhage required immediate removal, and repacking of the cavity, which controlled the bleeding. Incisions partially closed with silkworm gut. Patient stood operation very well.

July 28. — Fairly comfortable night. No vomiting. No cough. Bowels moved this morning. Pulse, 148. Respiration, 52. In the evening was slightly distended, and complained of pain in lower abdomen. Analysis of urine. S. P. T. Albumin. Few blood globules. Hyaline and fine granular casts.

July 29. — General condition improved. Pulse, 124. Respiration, 40. Bowels moved freely. First dressing done; gauze soaked with bloody discharge, odorless; no evidence of suppuration.

Pathological Report. — Probably Hemorrhagic Pancreatitis or Peripancreatitis, with Fat Necrosis.

July 31. — All wicks removed, except one in each incision. Considerable dark liquid blood followed removal of packing from lateral incision; quickly stopped. Wounds irrigated with salt solution. New wicks inserted.

August 1. — Remaining wicks removed. Irrigated from one incision through to other. Rubber drainage tubes applied. Discharge less. Continues to improve.

August 4. — Pulse, 124. Temperature, 101°. Respiration, 35. There is a free discharge of brownish thick turbid fluid, with numerous shreds from both incisions; odorless. Wound irrigated and dressed twice daily. Patient complains of some pain in left hypochondrium. Takes nourishment well, and is receiving free stimulation. Oxygen s. o. s. cyanosis.

August 6. — Twice since last date has had periods of delirium and unconsciousness with rapid pulse and respiration. This morning respiration is labored; patient cyanotic; tracheal râles. T., 101°; P., 140. R., 50. Signs of consolidation remain in the left lower lobe.

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coarse râles in both chests. In left lumbar region there is tenderness, slight bulging, and dulness. On account of these signs an exploratory incision was made under cocaine in the left lumbar region. No pus was found in the retroperitoneal space; incision was packed.

August 13. — Condition rather better. Color good. T., 99.8. P., 124. R., 36. Discharge from abdominal incision is more free, and consists of a thick brownish material with numerous sloughs. Lumbar incisions clean and healing.

August 20. — Several large masses of sloughing tissue was washed out to-day.

Pathologist's Report. — Necrotic fat tissue with considerable hemorrhage.

August 24. — Pulse and respirations continue elevated; no cyanosis. No expectoration. Signs continue in left lower lobe. To-day there is biliary fluid on the dressing. A piece of bowel in the lower angle of the right hand incision has perforated, allowing the escape of intestinal contents. Closed with Lembert sutures.

August 28. — Attempt to close fistulous opening unsuccessful, and a second one has appeared just above the first. Discharge from incisions is diminishing in amount.

September 3. — Tube omitted from median incision. Lumbar incision healed. Third incision presents deep sinus above, and two openings in exposed knuckle of gut below. Discharge is less in amount, stained with bile, and mixed with intestinal contents which escapes from the fistulæ. General condition slightly improved.

September 5. — There is some digestion of the skin about the intestinal fistulæ.

September 10. — Patient appeared as well as usual this morning. T., 99, P., 120, R., 44. Binder had just been unpinned preparatory to dressing, when blood was noted gushing from incision in right side. Patient quickly became blanched. Active bleeding stopped quickly. As soon as preparation could be made light ether was given; incision enlarged, and cavity packed with gauze. Foot of bed elevated. Salt infusion and stimulants were given subcutaneously. Patient reacted somewhat, but pulse gradually failed, and patient died at 1.45 P.M., eight weeks and three days after the operation.

Autopsy. — Dr. Steensland, three hours post-mortem.

Body of a well developed, very well nourished women, thirty years old. Healed operation incision in epigastric region in median line, and one in left lumbar region. Longitudinal incision 12 cm. long in epigastric region to right of median line.

Peritoneal cavity: Extensive, firm, fibrous ahesions about the two epigastric incisions, involving chiefly the omentum between the transverse colon and the pyloric end of the stomach. From the skin incision a passage leads into the lesser peritoneal cavity. The walls of this passage and of the lesser peritoneal cavity have a dirty blackish

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appearance. The lower lobe of the left lung is firmly adherent to the parietal and diaphragmatic pleura. When these are separated, a hole in the diaphragm 6 cm. in diameter, surrounded by blackish necrotic borders, is revealed. Through this is projecting a perfectly free blackish mass, about the size and shape of a normal pancreas. It probably passed up into the pleural cavity after the adhesions of the lung to the diaphragm were separated. On section it is blackish in color, and shows a few grayish markings, suggesting the lobulation of pancreatic tissue. The mass is soft, and of a somewhat pasty consistence. The cavity contains no fresh blood clot. The spleen is completely concealed by firm adhesions. When the splenic flexure of the colon is separated from its relation with the lesser peritoneal cavity its external surface appears blackish necrotic, and a hole in the wall 1 cm. in diameter with blackish necrotic borders is found.

In the region of the operation incision over an area 4 cm. in diameter the same blackish appearance of the external surface is seen. The wall is here much thinned, leaving practically nothing but mucosa. The pancreas is concealed by the same blackish discoloration. The left border of the liver is bound to the anterior wall of the stomach by firm fibrous adhesions. The general peritoneal surface is smooth and glistening, presenting no evidence of inflammation. Numerous fat necroses in the tissue surrounding the lesser peritoneal cavity, the largest 6 cm. in diameter. Some are considerable harder than the surrounding fat.

Pleural Cavities. — Upper lobe of left lung free. Few fairly firm fibrous adhesions over lateral and posterior surfaces of middle and lower lobes of right lung.

Lungs. — On section lower part of left lung darker in color than surrounding tissue, lax and apparently collapsed. Upper portion of left lung and all of right lung, pink and downy. No nodules at apices. On section some color presented. Mucosia of bronchi pale. Bronchial lymph nodes not enlarged.

Spleen on section, pale red, soft. Lymph nodules distinct, trabeculæ indistinct. Considerable increase of pulp.

Gastro-intestinal Tract. — Mucosa, except as described above, pale. Small intestine contains little bile-stained fluid material, with no evidence of blood. Transverse colon contains 50 gm. of fresh blood clot. Perforating ulcer of splenic flexure and another of upper part of jejunum.

Pancreas. — Probe readily introduced into pancreatic duct which passes through the centre of practically the whole length of the pancreatic tissue. Mucosa of duct smooth and pale. Its orifice is in common with the bile duct. Pancreas extends from the duodenum to spleen and adrenal. It is apparently slightly smaller than normal. Pancreatic tissue is lax. On section color is more yellowish

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than normal, and the lobular markings are somewhat indistinct. In the intestinal tissue are a few fat necroses, the largest 5 mm. in diameter.

Liver wt., 1280 gms. Very pale, smooth and of normal consistency. On section very pale, lobular markings distinct. Gall bladder filled with small gall stones and a small amount of normal appearing bile. Mucosa normal. Mucosa of common bile duct pale. No gall stones present in the duct.

Microscopic.

Subsequent careful examination by Drs. F. B. Mallory and H. C. Lowe of the mass so closely resembling necrotic pancreas projecting through the diaphragm showed that it consisted of nothing more than necrotic fat tissue.

Anatomical Diagnosis.

Hemorrhagic peripancreatitis.
Fat necroses of pancreas.
General superitoneal fat necroses.
Necrotic mass in lesser peritoneal cavity (fat necrosis).
Aperture connecting left pleura and lesser peritoneal cavity.
Atelectasis of left lung.
Hemorrhage into colon.
Localized chronic adhesive peritonitis.
Cholelithiasis.
Perforating ulcer of splenic flexure of colon.
Perforating ulcer of upper part of jejunum.

Remarks.

This case presents many points of interest, and though resulting fatally, there can be no doubt that life was prolonged by the operation, and might have been saved, had the abscess extended into the left lumbar region instead of perforating the diaphragm into the pleura.

The patient's condition on entering the hospital was so bad that a very grave prognosis was given, and on acccout of the condition at the base of the left lung it was decided to dispense with general anesthesia. When owing to the necessity for a second incision and extensive manipulation, ether had to be given, the operation was performed as rapidly as possible, and on account of a really alarming hemorrhage the cavity had to be rapidly stuffed with gauze. A fatal prognosis was given immediately after the operation. The course of

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the abscess upward through the diaphragm points to an early infection extending probably to the left pleura, and perhaps accounting for the signs which were noted at entrance over the lower left back. The walling off of this process may have accounted for the process thought to be a pneumonia which followed the operation. If the lower left pleura had been drained by resecting a rib it is possible that the patient might have been saved. Pocketing was expected, and looked for in the left lumbar region, but naturally not found. The abscess cavity lay well up under the diaphragm, and the mass of necrotic tissue extended through the hole in the diaphragm above the spleen.

The fact that enough nearly normal pancreas was left at the time of the autopsy to raise a doubt whether the disease was not almost entirely a peripancreatitis, with no permanent injury to the pancreas other than an extension inward from its periphery of a few areas of fat necrosis, would indicate that in case of recovery there would have been no permanent interference with the functions of the pancreas. The presence of gall stones in the case is noteworthy. The fact that the mass found at autopsy projecting through the diaphragm, and thought at first to be sloughing pancreatic tissue, proved on careful microscopic examination to be nothing more than necrotic fat tissue, points to the case having been one of peripancreatitis rather than pancreatitis. The normal condition of the ducts renders it difficult to account for the disease by the escape of pancreatic fluid. The discovery that this mass so closely resembling necrotic pancreas was really necrotic fat tissue casts a doubt on the reported cases in which patients have recovered after passing a necrotic pancreas by rectum. (Trafoyer, quoted by Chiari.) May not the so-called necrotic pancreas have been merely a mass of necrotic fat?

Case III. — Summary. Acute Hemorrhagic Peripancreatitis. On fourth day, operation, in spite of severe prostration, on account of symptons of epigastric peritonitis. Pancreas dark in color and surrounded by areas of fat necrosis. Incision and gauze drainage. Gall bladder and ducts noted to be full of stones. Death three and one-half hours after

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operation. Pancreas removed after death. Duct of Wirsung and central portion of pancreas normal. The connective tissue surrounding the pancreas infiltrated with blood. Areas of fat necrosis numerous over the surface of the pancreas, and diminishing rapidly toward the central portion, which was normal in appearance.

Clinical History.

[Abstract from Hospital Record.]

M. W., age thirty-one, housewife, entered July 11, 1900, at 11 P.M.; service of Dr. H. W. Cushing.

Has had three attacks which patient says were "similar to present," the first five years ago; the second eight months ago; the third three months ago. No one of these attacks ever so severe as present. Previous attacks were associated with abdominal pain, vomiting, and fever; in one attack, at least, patient was jaundiced. (Patient too sick to give an accurate account of symptoms.) In interval, since last attack, has been well; able to eat anything; bowels regular; no pain.

The present attack began on July 6, in the afternoon, with sudden sharp pain, which started in the back, between the shoulders, and ran round to the epigastrium. Feverish, but no chill. No vomiting. Bowels moved naturally. The next two days was more comfortable; slept fairly well; went to a dispensary for treatment. On July 9 pain became much more severe. Fever continued. No chill. Vomited twice. Bowels moved a number of times following castor oil. Vomitus yellow and bitter. Dejecta loose, brownish, not particularly offensive; not bloody. Unable to sleep on account of pain. No cough; no pain in chest. Yesterday, pain continued. Vomited once. Bowels moved once. Abdomen began to distend. Motions of breathing became painful. Obliged to lie on back, as every motion aggravated the pain. To-day symptoms have continued. Distention has increased, but there has been no nausea or vomiting. Bowels have not moved to-day, but patient has passed gas. Frequent eructations also of gas. Pain is a dull ache in back and abdomen. Not localized in any particular spot at any time; but in upper rather than in lower abdomen. Very restless; unable to sleep; mouth dry. Urine has been darker than normal, but not bloody; passed normally. Has noted no yellowness as in previous attack.

Corpulent; face dusky; eyes bright; pupils equally contracted. Tongue dry, with white coat. Whole surface of body covered with cold sweat. Hands and feet cold. Pulse, 128, weak. Temperature, 101.4°. Respiration, 38, shallow. Slight yellowness of conjunctivæ. *Heart:* sounds weak; no murmurs. *Lungs:* negative. No œdema of ankles. Abdomen markedly distended; generally tender, especially in epi-

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gastrium and left hypochondrium. Marked spasm in these regions. Slight tenderness and spasm over rest of abdomen. Distinct resistance in epigastrium as of a prominent tumor, which was tympanitic, as was the rest of the abdomen. Operation under cocaine proposed, but refused. Ether was therefore given at 3.30 A.M., July 12. Operation by the writer. Incision 5 inches long, median line, above umbilicus. General peritoneal cavity normal. Transverse colon greatly distended. On tearing through transverse mesocolon, at the bottom of the lesser peritoneal cavity, there was felt the much-thickened pancreas. Seen to be dark in color, and studded with areas of fat necrosis. A small amount of turbid fluid lay in the bottom of the cavity. Gall bladder and ducts contained a large number of small gall-stones. On account of the serious condition of the patient nothing further was done than to insert rubber tube and three strips of gauze down to necrotic pancreas. Incision partly closed with silk. Patient left table in great shock. Duration of operation 15 to 20 minutes. During and after operation, free stimulation by brandy, strychnia, atropine, digitalis and salt solution. Patient rallied slightly, but the pulse gradually failed, and she died 3½ hours after the operation.

Remarks.

This case was operated upon for the reason that the symptoms suggested a general peritonitis, beginning in the epigastrium, and incision irrigation and drainage in this event was thought to give a possible chance to the patient.

The operation showed that the prostration of the patient was not due, as thought probable, to a general peritonitis, but to a pancreatitis. This marked tendency to collapse and shock in this disease has been explained by various writers as due to the close relation of the organ to the solar plexus.

The result of the examination of the pancreas agreed with that of the autopsy on Case II., as showing that the case was a peripancreatitis rather than a panpancreatitis, so to speak, and indicating that if recovery had taken place the pancreas would not have been sufficiently damaged to interfere seriously with its functions.

Case IV. — Summary. Acute hemorrhagic pancreatitis in a male thirty-seven years of age who had had previous attacks of epigastric pain. Seen by surgeon, Dr. W. P. Bolles, two weeks after onset of attack. Operation contraindicated by poor condition of patient. Death on third day after admission to hospital.

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Autopsy.

Hemorrhagic pancreatitis with necrosis of pancreas and abscess in lesser peritoneal cavity. Extensive disseminated necrosis of subperitoneal fat. Cholelithiasis.

Clinical History.

[From Hospital Record.]

G. L. S., age thirty-seven, married, book-keeper, was admitted to the service of Dr. W. P. Bolles on January 11, 1899. Four months before entrance had an attack of epigastric pain, vomiting and jaundice, lasting five days. Two months later a similar attack, lasting one week. Two weeks before entrance the present attack began with a dull ache in the right hypochondrium and vomiting, with prostration. After a week the pain and vomiting ceased, but retching continued. During the five days preceding his entrance he had two chills.

Examination.—Well developed, rather than thin. Abdomen somewhat distended, and tympanitic, except for slight dulness in the flanks. Temperature, 103.2°. Pulse, 124, weak. Slight tenderness to pressure in the right hypochondrium. The upper border of the liver was slightly higher than normal, and the lower border, though somewhat masked by tympany was apparently somewhat lower than normal. The facial expression was dull and apathetic, and the patient looked very sick. On January 12 the bowels moved freely without cathartics. The patient was dull and slightly delirious at times. Movements semi-solid in consistency. He was seen by Drs. Jackson, Thorndike, and the writer in consultation, and operation advised against, owing to the weakness of the patient. After a fairly comfortable night with slight fall in temperature the patient had a severe chill, followed by collapse, requiring free stimulation, on January 13, the second day after entrance. He did not rally under stimulation, sank into coma, and died at 11 P.M. The diagnosis in this case lay between abscess of the liver and pancreatitis, inclining to the former. At no time during the patient's stay in the hospital was his condition good enough to permit of operation.

At the autopsy by Dr. F. B. Mallory, on making the first incision there were found small yellow opaque areas in the fat tissue of the abdominal wall just beneath the peritoneum. Similar spots from 1 to 4 or 5 cm. in diameter were found all over the surface of the great omentum. They were slightly raised above the surrounding fat tissue, more or less circular in outline, with edges usually irregular. Similar areas were found in enormous numbers in the fat tissue beneath the lining peritoneum, everywhere in the abdominal cavity, being especially numerous in the mesentery. The lesser peritoneal

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cavity was found to be much distended, and filled with clotted blood and hemorrhagic fluid, almost a litre in quantity. At the bottom of the lesser peritoneal cavity was a dark, reddish brown, friable mass, all that remained of the pancreas. The cavity had extended beyond the ordinary limits of the lesser peritoneal cavity on the left side over the kidney, and apparently ruptured into the general peritoneal cavity, a reddish gray fluid oozing up on carefully drawing up the coils of small intestine on the right side. In the general peritoneal cavity was a small amount of reddish yellow exudate, most abundant in the pelvis. On opening the duodenum there was a thin place in the wall below the pylorus, at which point the contents of the lesser peritoneal cavity seemed just on the point of breaking into the duodenum.

The papilla of the common bile duct appeared normal, and no obstruction of any sort could be found in or near it. In the gall bladder there were numerous small stones. The pancreas seemed to be destroyed right up to the wall of the duodenum. The fat capsule of the left kidney formed a part of the wall of the lesser peritoneal cavity. Yellowish areas, similar to those already described, were found throughout this fat tissue, both in front of and behind the kidney. In the fat tissue on the left side below the kidney, along the outer border of the psoas muscle, was a great mass of necrotic fat. At the middle of the seventh rib on the right side and along the lower border of the tenth rib beneath the costal pleura were areas of necrosis.

Anatomical Diagnosis: Necrosis of pancreas with hemorrhage; acute peritonitis; cholelithiasis.

Remarks.

In this case, the only one in the series in a male patient, we have the presence of gall stones and a history of previous attacks. In the two weeks which elapsed before the patient entered the hospital necrosis of the entire pancreas with diffusion of patches of fat necrosis over the entire peritoneal cavity and extensive suppuration in and about the lesser peritoneal cavity had occurred.

It does not seem impossible that if operation had been performed early, after the primary shock of the beginning of the attack, perhaps, but before the process had become so extensive, and if adequate drainage had been provided and maintained, a fatal issue might have been averted.

Certainly if operation is to be of avail in these cases it must be performed before the process has become as extensive as it had in this case when he first came under observation.

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Case V. — Summary. Localized necrosis of pancreas with fat necrosis. Exploratory laparotomy on third day of disease. Diagnosis of appendicitis or epigastric peritonitis of unknown origin. Evacuation and drainage of small abcess of the pancreas. Death on third day after operation. No autopsy.

Clinical History.

[Abstract from Hospital Record.]

K. T., aged forty-five, a widow, was admitted to the service of Dr. H. W. Cushing on April 20, 1899. Her previous history showed that she had had eight normal deliveries and suffered from a hernia. During the last six years she had had repeated attacks of abdominal pain, constipation and vomiting, lasting several days.

Two days before entrance she was seized with severe abdominal pain and vomiting. The second day of the attack the pain had become more on the right side, and the vomiting was severe and continuous, the abdomen became tender, and she had a chill.

On entrance she was found to be fairly well nourished, sick and apathetic in appearance. The temperature was 99° and pulse, 100. Tongue slightly coated. Constant vomiting of greenish material. Abdomen distended and generally tender, though this symptom was most marked in the region of the gall bladder and the left iliac fossa. There was muscular spasm on deep pressure. No tumor was made out. Vaginal and rectal examinations were negative. The following night the bowels were moved by an enema, and considerable gas was passed. On April 21, the third day of the attack, there was slight tenderness over the entire right side of the abdomen, most marked over the region of the appendix. There was also marked tenderness in the epigastrium, and percussion in this region showed a tympanitic area suggesting a dilated stomach. The patient was seen in consultation by Dr. C. F. Withington, and operation advised. Exploratory laparotomy was performed by Dr. J. C. Munro. Through a short median incision below the umbilicus the appendix was found apparently somewhat thickened, lying high, under the border of the liver, slightly adherent. It was ligated and removed. Then a careful examination of all the intestines was made for constriction, during which a smooth tumor, pulsating with the aorta was found in the position of the head of the pancreas. An incision was then made in the epigastrium, by which the adherent colon was accidentally opened, and closed at once with silk. Then the omentum and intestines were packed off to allow a view of the posterior peritoneum and a gray diphtheritic patch found on the peritoneum over the tumor, which was punctured with a director, allowing the escape of a little sero-purulent material and fat necrosis.

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A cavity in the pancreas the size of an English walnut, which lay beneath this patch was curetted and drained with a glass tube. The epigastric wound was packed with gauze around the tube and the other wounds sutured. The operation was well borne. Free stimulation and cathartics were the line of treatment after the operation, and the following day the patient's condition made marked improvement, and the bowels moved. The second day after operation vomiting began, and the general condition grew worse. Death occured at noon of the third day following the operation. Cultures from the abdomen at the time of the operation were sterile. Examination of the material removed from the cavity in the pancreas showed fat necrosis.

Remarks.

This case is interesting as presenting grave symptoms depending on a localized necrosis rather than a general inflammation of the pancreas. It is unfortunate that no autopsy was obtained, as much light might have been thrown on the condition of the pancreas and surrounding organs.

Case VI. — Summary. Pancreatitis. Severe attack with marked prostration. Prodromal symptoms for three days. Operation on fifth day, for symptoms suggesting a general peritonitis. Death on the operating table. Imperfect autopsy showed peritoneum studded with areas of fat necrosis.

M. N. M., fifty, married, housewife, was admitted to the City Hospital, service of Dr. H. W. Cushing on May 4, 1898. Eight days before entrance she began to suffer from indigestion and heartburn. Five days before entrance was suddenly seized with intense pain in the region of the gall bladder, which lasted several hours, and required three quarters of a grain of morphia. She vomited several times. After the subsidence of the pain tenderness remained, but gradual improvement took place till the day before entrance, when the pain returned, attended by vomiting and prostration. To-day the prostration has increased, and fœcal vomiting begun.

Examination shows general distention of abdomen, and slight general tenderness, without marked spasm. The face is anxious, pulse rapid, but of fair strength. Slight edema of legs. Urine normal. Dr. Munro operated under ether. The patient took ether badly; became cyanotic, with constant fecal vomiting. An incision four inches long was made through the anterior abdominal wall, and exploration begun, when the patient suddenly collapsed and died, in spite of energetic stimulation, etc.

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A hasty examination after death showed a mild general peritonitis, and the parietal peritoneum and mesentery were found studded with fine white dots. Fresh adhesions were found everywhere. Several of the white dots were removed, and on microscopic examination reported by Dr. F. B. Mallory to show fat necrosis.

GENERAL SUMMARY.

Six cases of pancreatitis in patients between thirty and fifty years of age, five of them women and four having also gall stones.

Definite diagnosis was made in no case, the diagnosis being approximated three times (Cases I., II., and IV.). Operation in five cases. One recovery. One death two months after operation from inadequate drainage. Two deaths from shock. Operation declined by surgeon in the single non-operated case owing to poor condition of patient.

VARIETIES OF THE DISEASE.

Cases II. and III. should be properly classified as peripancreatitis. Case IV., as necrosis of the entire pancreas, following undoubtedly upon a hemorrhagic pancreatitis. Case V. was a localized necrosis of the pancreas resulting in abscess.

REMARKS ON DIAGNOSIS,

as illustrated by the three cases seen by the writer, Cases II., III., and V.:

1. In differentiating from perforating gastric ulcer we find the pain not quite so sharp, and the tenderness on light pressure not so acute. Moderate tenderness on deep pressure has characterized the cases of pancreatitis; acute pain on light pressure, the cases of perforating gastric ulcer.

2. The sensation of fulness, as of a tumor in the epigastrium overlain by the stomach, has been noted in all the cases observed by the writer, and in Case I. observed by Dr. Munro. In Cases I. and II. a tumor could be definitely delimited.

3. Muscular spasm was not so marked in these cases as in perforating gastric ulcer or acute appendicitis. In both

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perforating gastric ulcer and pancreatitis we have localized epigastric tenderness and spasm, but both more marked in the former than the latter condition. This comparison is based on the personal observation of four cases of perforating gastric ulcer verified by operation, which have been observed by the writer in the last eighteen months.

An absolute diagnosis is generally impossible. The diagnosis narrows down to an acute peritonitis originating in the epigastrium, which, from whatever cause, demands exploration of the abdomen.

CONCLUSION AS TO THE SURGERY OF PANCREATITIS.

Milder cases of acute pancreatitis or peripancreatitis recover both with and without operative intervention. Severer cases require operation, which should be performed early, for the following reasons:

1. Because the primary hemorrhage in itself (Flexner) leads to necrosis and disintegration of gland tissue, and the hemorrhage may be stopped and further necrosis both of fat and gland tissue prevented by gauze packing and adequate drainage. (Cases I. and II.)

2. Because the patient is in far better condition to withstand an operation early in the disease than later when weakened by suppuration in the lesser peritoneal cavity, and necrosis of much fat and gland tissue.

A certain class of cases in which the primary shock is so severe as to render operation out of the question must be excepted from the operative cases.

The mortality from pancreatitis will undoubtedly be high, but there is reason to hope that with early operation, and adequate provision for lumbar drainage, it may be considerably diminished.

REMARKS ON TECHNIQUE.

As the diagnosis must, in a large percentage, be tentative, the first or exploratory incision should be made in the median line above the umbilicus. This incision may, in severe cases, be made with advantage under local anesthesia. On account of the weak condition of most of the patients rapid operating

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is essential. The gastro-hepatic omentum must be traversed to reach the lesser peritoneal cavity. Masses of blood clot and necrotic fat should be rapidly evacuated. Further hemorrhage may be stopped by gauze packing. It will be generally impracticable to search for bleeding points.

Where the mass of blood clot, or the abscess cavity has extended into the left lumbar region, adequate drainage must be provided by a lumbar incision made on the finger passed into the cavity. This dependent lumbar drainage is probably the most important step of the operation, since in the majority of cases it will probably not be possible to drain successfully through a median incision, as was done by Finney in Thayer's case. In case symptoms at the base of the left pleural cavity point to pocketing of pus above the spleen the subphrenic space should be drained by resecting the tenth or eleventh rib in the posterior axillary line. The pleural cavity will be opened, but will be probably walled off by adhesions. At any rate, drainage of this pocket is essential, in order to avoid perforation of the diaphragm by the abscess, which happened in Case II. Drainage of the sub-diaphragmatic space above the spleen would probably have saved this patient, as the upper part of the pleural cavity was walled off. Careful diagnosis, rapid operating, and careful nursing will be necessary to save these cases, as the proximity of the inflammatory process to the solar plexus, the diaphragm, heart, lungs, stomach, and duodenum, together with the deep situation of the pancreas, all contribute to make its inflammation so dangerous and difficult as to tax to the utmost the art and skill of the surgeon.

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IV.

MALIGNANT ENDOCARDITIS, AN ANALYSIS OF FIFTY-NINE CASES.

By Henry Jackson, M.D.

The name malignant endocarditis is the most appropriate to designate a variety of acute heart disease, which runs a varied course as to duration, but so far as we know ends invariably in death. No definite pathological name can be assigned to this disease in that various pathological lesions may be found in cases which during life presented identical symptoms. Post-mortem we may find soft grayish granulations, lesions usually associated with simple acute endocarditis, prominent "cocks' comb" like granulations, or the new growth may be represented by large friable masses prone to ulceration, which often lead to ulceration of the valve curtains and, secondarily, to perforation of the valves. This last mentioned pathological condition gives rise to a common name for the disease under consideration, namely, "ulcerative endocarditis," an objectionable term, in that ulceration or perforation is present in only a part of the cases which from their rapid course and serious symptoms deserve the name of malignant endocarditis.

Also the term septic endocarditis is open to objection, as it is descriptive of only one phase of the disease, and is by no means present in many other cases whose course is equally malignant, though the symptoms should lead rather to the word typhoidal than septic, if we were to describe the disease according to its most prominent symptoms.

The diagnosis is difficult, and in certain cases impossible, though in most cases a careful consideration of all the signs

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and symptoms should at least lead one to consider the possibility of a malignant endocarditis. In many of the cases reported the diagnosis was not even considered, especially when the lesion was situated in the right side of the heart and in three cases where the new growth was on the walls of the heart, hence gave rise to no suggestion of heart disease, by causing abnormal sounds.

The disease may arise primarily so far as we can determine, be secondary to some acute infectious disease as pneumonia or diphtheria, or it may be only one of the local manifestations of a general septicæmia, secondary to some suppurative process. From a study of these reported cases pneumonia does not appear to play the important role in the etiology of malignant endocarditis that is usually attributed to it. Pneumonia was present in many of the cases, but the consolidation was dependent upon infarction secondary to emboli thrown off from the valves, or was present in the form of lobular pneumonia, and, therefore, is to be looked upon as a result of the endocarditis or as a complication, and not as a disease which gave rise to the endocarditis. This distinction is of importance, as many authors speak of pneumonia as a prominent etiological factor in malignant endocarditis. Osler gives pneumonia as the primary disease in eleven of twenty-three private cases in Montreal, and in fifty-four of two hundred and nine cases collected from medical literature. In two only of the fifty-nine cases is there fair reason to suppose that the endocarditis was secondary to acute lobar pneumonia. In one of these cases the temperature fell by crisis after the patient entered the hospital, the crisis being followed by an irregular fever of septic type, evidently dependent upon the endocarditis. In the other case the two processes were apparently coincident, the patient dying after being twenty-four hours in the hospital.

Malignant endocarditis is due to the growth of bacteria in or upon the valves, though as yet no one organism has been found to be in preponderance, and from our present knowledge we must consider that several organisms may produce similar or identical lesions: pneumococci, the staphylococcus aureus, streptococci, and gonococci have all been found in

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the valves alone in pure culture or in combination, as well as several other organisms which have not been identified. All these organisms were found in some of the cases in the present series.

The friable character of the lesions in most cases of malignant endocarditis, combined with the markedly infectious nature of the lesions is the cause of the many secondary pathological processes associated with this disease, emboli being easily carried to many parts of the body. Upon the clinical evidence presented by the results of these emboli, as infarctions in various organs and petechial hæmorrhages in the skin, we often base our diagnosis of the disease. Hæmorrhages in the skin, either petechial in form, or more rarely of large extent, are very common in this disease, and often of paramount importance in the diagnosis.

The present series of cases includes 59; in 43 the diagnosis being confirmed by autopsy; in 16 no autopsy was obtained and, therefore, some doubt may exist as to the correctness of the diagnosis.

Forty-three cases with autopsy: In these cases the acute disease was distributed as follows:

Aortic valves	9 cases
Aortic and mitral valves	10 "
Mitral valve	15 "
Right side of the heart	6 "
Endocardium of ventricle	3 "

In five of the nine cases of aortic disease the acute endocarditis was implanted upon a chronic endocarditis; in all these cases there was enlargement of the heart. In the four cases without chronic disease the largest heart weighed 390 grammes, and the smallest 315. In one of the cases, entered as "much enlarged," there was in addition to the endocarditis, an adherent pericardium with a relative insufficiency of the mitral valve. The anatomical lesion was correctly diagnosed in seven cases; in one case a murmur was found only at the apex, and in one case no examination was made, as the patient was moribund on entrance.

In seven of the ten cases of aortic and mitral disease there was also a chronic endocarditis. In one case there was no

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enlargement. The weight averaged greater than in the cases where only the aortic valve was involved. Two of the hearts weighed respectively 590 and 670 grammes, while a third, with the adherent pericardium, weighed 1,300 grammes. The anatomical lesion was correctly diagnosed in five cases; in three, only the mitral lesion was diagnosed. In two, on account of the condition of the patient, practically no diagnosis was possible, as to the location of the heart lesion.

In the fifteen cases of mitral disease there was chronic disease in only five. In eleven of the cases there was enlargement, but to a much less degree than in the aortic cases, only two of the hearts weighing over 400 grammes, and none of them reaching 500 grammes. The anatomical lesion was correctly diagnosed in ten of the cases, no examination was made in four, and in one case an ulcerated mass was so situated on the valves that in all probability no incompetency was caused.

In six cases there was disease of the right side; in two there was an adherent pericardium, with chronic mitral disease, the tricuspid valve being acutely diseased in these two cases. In two cases the pulmonic valve alone was diseased, and in two cases the tricuspid alone was involved. This series confirms the usual law that in acute disease of the right side of the heart the tricuspid valve is more often affected than the pulmonic valve. There was no enlargement of the heart in the four cases in which the disease was limited to the right side; in the two cases with adherent pericardium the heart was much enlarged.

As disease of the right side of the heart is rare, the question of the diagnosis of the seat of the lesion is of interest. In one case no examination of the heart was made after entrance, at which time no evidence was found of disease of the heart. In five cases frequent and careful examinations were made. In one case only was a correct diagnosis made; namely, in a case of pulmonic disease in which a "to and fro murmur" was heard in the third left intercostal space close to the sternum. In the other case of pulmonic disease "a distinct diastolic murmur" was heard over the pulmonic valve. In this case, I regret to say, a correct diagnosis was

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not made, though the physical signs were marked; the man had pulmonary tuberculosis, and malignant endocarditis was not diagnosed, the supposition being that the murmur was hæmic in origin, a condition said to occur in rare instances. (Case in the service of Henry Jackson).

In one of the cases of tricuspid disease, combined with mitral disease, there was a double murmur, supposed to be mitral, a pericardial murmur, and a double murmur, supposed to be aortic, the last mentioned probably dependent upon the tricuspid lesion. In the other case combined with mitral disease there was a loud murmur at the apex, and a systolic and diastolic murmur "heard all over the heart."

In the three cases of endocarditis of the ventricle, two were in the left ventricle and one in the right; no enlargement and no chronic disease. No diagnosis was made, and probably no diagnosis could have been made. In all the heart sounds were weak, in one there was reduplication, and in one, where the new growth was situated upon one of the papillary muscles of the tricuspid valves, a faint systolic murmur was heard over the heart, perhaps due to tricuspid regurgitation.

In the forty-three cases of acute malignant endocarditis there was a pre-existing chronic disease in nineteen cases; in this series chronic heart disease was found less often than one would expect from statistics published by other authors.

In the forty valvular cases the pathological appearance was characterized as follows :

Granulation with ulceration and perforation	9 cases
Granulation and ulceration	10 "
Large friable masses with perforation	1 case
Vegetation and ulceration	2 cases
Large vegetation	7 "
Soft gray granulations	9 "

This table shows that in one quarter of the cases presenting the symptoms and running the course of malignant endocarditis the lesions found were simple soft gray granulations, similar to lesions found in cases which, during life, have shown no evidence of serious acute heart disease.

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Spleen. — In one case the statement is made that the spleen was not enlarged; in all the other cases it was enlarged, and in thirty cases the weights are given as follows:

1 case	125 grammes.		
3 cases	200 "		
4 "	250 "		
6 "	300 "		
3 "	350 "		
5 "	400 "		
5 "	500 "		
1 case	810 "	(Infarction.)	
1 "	1310 "	"	
1 "	1680 "	(No infarction.	No chronic disease.)

Infarctions were found in thirteen cases and small abscesses in two. The increase in size may, therefore be dependent upon the septic process independently of infarctions. The constant presence of enlargement of the spleen demonstrated by autopsies is an important element in diagnosis.

Kidneys. — Infarctions were found in six cases and small abscesses in two cases.

Brain. — Miliary abscesses were found in four cases and embolism of the artery of Sylvius in one case; acute purulent meningitis was found in three cases. Infarctions or miliary abscesses were found in the lungs in all of the cases where the lesion was situated in the right side of the heart. Pneumonia was found in ten cases, but of recent date in all cases but one, and therefore, evidently not to be considered as of etiological importance in the causation of the endocarditis.

The above short resumé of the lesions found in malignant endocarditis and of the complications which may be directly dependent upon the disease prepare one for the complex clinical phenomena presented during life. Malignant endocarditis is a disease which is often not correctly diagnosed, yet it is one in which a review of the lesions found at autopsy usually offers a clear and satisfactory explanation of all the varied symptoms noted during life. Therefore, it is a disease in which a careful weighing of all symptoms, combined with a knowledge of the lesions produced by the disease, should usually lead to a correct diagnosis.

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Clinical history of forty-three cases confirmed by autopsy. — Males, 24. Females, 19.

1	case	10 years
4	cases	16–20 years
15	"	20–30 "
17	"	30–45 "
5	"	50–60 "

These data show that the disease is about equally prevalent in men and women, and that it is essentially a disease of early adult life to middle age, though a few cases were observed under twenty and a few over fifty years.

Several of the cases were moribund on entrance, or so delirious that no reliable previous history was obtained. Most of the cases gave no history of any previous sickness of value in determining the etiology; in eighteen no previous diseases. In eight several attacks of acute polyarticular rheumatism in years gone by; in six a history suggestive of preëxisting heart trouble for several years; in a few tubercular disease. In only a few cases was a history obtainable of an acute disease which was probably the cause of the endocarditis, but these few cases are of much interest.

Pneumonia, Diphtheria, Carbuncle, Abscess, each 1 case.
Gonorrhœa: one, two, and three months ago, 3 cases.
Childbirth, or Miscarriages, 4 cases.

In four other cases the following conditions were found at autopsy:

Acute prostatitis and abscess of ovary, each	1 case.
Abscess of epididymis	1 "
Putrid salpingitis	1 "
Purulent endometritis	1 "

In recent years attention has been drawn to the important rôle played by gonorrhœa in acute and chronic heart disease, and gonococci have been found in the heart. In none of these three reported cases were there any other predisposing causes for the endocarditis.

In some of the cases the endocarditis apparently developed after admission to the hospital, the patients having been

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admitted for some other definite disease, with no evidence of any acute heart trouble, for instance, a case admitted as pneumonia, another for carbuncle, and five cases admitted for heart disease of a chronic type, with the usual symptoms of failing compensation.

In thirty-one cases sufficiently accurate data were given to estimate the duration of the trouble previous to entrance to the hospital; namely, twenty-one cases: one three weeks; seven cases, four to eight weeks; two cases, three months, and one case five months.

The first symptoms complained of were very varied, so that on entrance any one of many diseases might be considered as the probable diagnosis. On broad lines the chief types of disease suggested by the initial symptoms of this series of cases may be classified as:

Acute rheumatism, with cardiac complications.
Typhoid fever.
Septicaemia.
Pulmonary tuberculosis.
Malaria.
Meningitis, or some cerebral disease.

In five of the cases the initial symptoms were those of an ordinary attack of acute polyarticular rheumatism, often not of a severe type; in four other cases the patients were admitted for rheumatism, but the addition of chills, sweating, and vomiting suggested the possibility of a septic arthritis rather than a simple rheumatic arthritis. Two of the cases of gonorrhœa were admitted for a gonorrhœal arthritis. These represent the cases simulating acute rheumatism, with an endocarditis of the ordinary type.

Five cases were admitted, simply giving a history of being "weak and sick" for a variable time; six others as having had "fever, chills, and general weakness." In such cases typhoid fever is usually the disease first suggested to the mind of the physician. The septic type of the disease is not largely represented in this series; namely, the four cases admitted after labor, with a history of fever, vomiting, and chilly sensations, giving on entrance a typical history of

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septicæmia, though without evidence that the essential local manifestations of the sepsis were situated in the heart.

The early history of many of the cases was strongly suggestive of pulmonary tuberculosis in that in ten cases, all symptoms complained of pointed to the lungs as the primary seat of the trouble: cough, often with bloody expectoration, shortness of breath, general weakness, often chilly sensations or chills, and fever, make a series of symptoms which may well be considered as dependent upon pulmonary tuberculosis. The frequent recurrence in the records of the statement that no tubercle bacilli were found shows that this disease was considered as probable even after careful observation; two of the cases were sent to the pathologist as pulmonary tuberculosis, as tubercle bacilli were found in abundance, and the malignant endocarditis was not suspected. Three of the cases were admitted, with only a history of recurring chills; here, again, the frequent entry of the statement that no plasmodia were found shows that malaria was considered as the primary disease, or as a complicating factor in an acute rheumatism.

One case was admitted as cerebro-spinal meningitis in which at autopsy no lesions were found in the brain; the only symptoms before entrance to the hospital were severe headache and vomiting. Other cerebral cases will be referred to in the consideration of the diagnosis.

Vomiting and severe sweating, either with or without chills, were symptoms present in many of the cases. Petechiæ were noted in one case before the patient entered the hospital, though in the vast majority of the cases this important symptom appeared late, often only a day or two before death. In one case larger hemorrhagic areas appeared at intervals for several months before the patient entered the hospital, appearing at a time when the patient, who had chronic heart disease, considered himself as comparatively well.

Delirium is an important and one of the most common symptoms, being present in thirty-four of the cases. Stupor is frequently associated with the delirium, and in two of the cases actual coma was present. Cough was a prominent

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symptom in twenty-four cases, often accompanied by bloody expectoration. Petechiæ were seen in thirteen cases. This symptom, when present, is of the utmost value, indicating, as it does, that minute emboli, perhaps usually consisting of minute masses of tissue from the valves with bacteria, are spread broadcast through the circulation and arrested in the minute capillaries of the skin. Petechiæ may often be the one deciding factor to clinch the diagnosis in a doubtful case of fever with an endocardial murmur. Miliary subcutaneous pustules were seen in one case.

In every case in which an examination was made leucocytosis was found, not invariably when the patient entered the hospital, but during the course of the disease; the lowest count was 9,400 and the highest 32,000, the average being from 16–20,000. Leucocytosis is of great value in eliminating three diseases: malaria, in which it is not found; typhoid fever, in which it is very rare, except as the result of some complication secondary to typhoid fever (I have never seen leucocytosis in an uncomplicated case of typhoid fever, nor in a case accompanied by complications dependant upon the activity of the typhoid bacillus itself); acute tuberculosis, a disease in which it is rarely seen. We may then, by means of the blood count, rule out three diseases likely to be considered in the diagnosis of acute malignant endocarditis. The blood count is not alone of value in the differential diagnosis from acute articular rheumatism, as in this disease there is usually a leucocytosis of 15,000, and the white cells may be more numerous even in uncomplicated cases.

Heart. — The rapid growth of the lesions on the valves, together with the secondary destructive processes in the valves naturally cause marked and often rapid changes in the line of closure of the valves. These conditions are often marked in the clinical history, and are of importance in diagnosis as proving that some change has taken place in the valves. Such changes in the murmurs produced are by no means proof of the existence of a new growth upon the valves, as under rest and appropriate medication in chronic cases we often notice a marked change in the murmurs produced, but they are suggestive, and in certain cases may be

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pathognomonic of the condition of the heart. In six cases no cardiac lesion was found when the patient entered the hospital; in four of these cases a double aortic lesion was subsequently diagnosed from the development of murmurs with Corrigan pulse, and a pistol-shot murmur in the femorals; in two cases a mitral murmur was developed. Though a mitral murmur is often developed late in the course of many diseases as the result of a relative insufficiency, it is difficult to account for the presence of a well-marked aortic insufficiency without granting some new growth on the aortic valves. In several cases there was a marked change in the character of the murmur, and in two cases where murmurs were heard at entrance, new and entirely different murmurs developed during the course of the disease.

Aside from the cases moribund upon entrance in which no diagnosis was practical, in three cases there was a marked valvular disease in which no murmurs were heard during life; in two of these cases the lesion was so situated that in all probability the line of closure of the valves was not interfered with, and therefore, in all probability no murmur was produced. Enlargement of the spleen was recognized in twenty-two cases.

The pulse was rapid in most cases, in certain instances reaching 150 or more before death. In only a few instances was the pulse of such a rate that no serious acute disease was suggested as probable.

The typical course of the temperature was that seen in severe septicæmia, varying from 97° to 104°, or 105°. If the course was not marked by the excessive variations noted its course was usually irregular. In four cases there was only a moderate fever, and in three cases, which lived several days or more, there was no fever. In the three last-mentioned cases the fatal issue, the presence of infarctions or emboli and the general condition of the patient seem to confirm the diagnosis made by the pathologist of malignant endocarditis. The irregularity of the temperature, especially when chills were seen, marked the case as one of the types of septicæmia, leaving for more careful consideration the local lesions resulting from the sepsis.

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In 21 of the 43 cases, the disease was correctly diagnosed; in ten cases no diagnosis was possible, either because the patients were moribund on entrance, or on account of the obscurity of the symptoms.

In 10 cases the diagnosis was not made, though in all of them the light thrown upon the history by the autopsy showed that the diagnosis might have been correctly made if the signs and symptoms had been more carefully studied. A statement of the mistakes made is of interest, showing the wide range of diseases suggested by the possible complication of symptoms produced by this virulent disease:

Pulmonary tuberculosis	3 cases.
Pneumonia	1 case.
Pneumonia and heart disease	1 "
Renal disease and heart disease	1 "
Puerperal septicæmia	1 "
Debility following typhoid	1 "
"Cerebral"	1 "
Cerebro-spinal meningitis	1 "

In this series the duration of the disease was varied, as is usually observed, though in none of the cases was the disease prolonged beyond five months, as is occasionally seen.

1 week	1 case.
2–3 weeks	11 cases.
4–6 weeks	13 "
Two months	5 "
Three months	5 "
Four months	2 "
Five months	1 case.

The average duration of a case of this disease may, therefore, be well compared to that of a case of typhoid fever, or acute miliary tuberculosis.

Organisms. — Cultures were made in 23 cases; in 19 cases definite organisms were isolated in pure culture, in two cases organisms were cultivated, but their identity was not determined; in two cases the cultures were sterile, and in one of these cases careful microscopic examination failed to show the presence of micro-organisms. This last case

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was one of general septicæmia, dating from a labor three months before the patient entered the hospital, and it is probable that the organisms had disappeared.

In the 19 cases the following organisms were found:

Streptococcus pyogenes	8 cases.
Pneumococcus	5 "
Staphylococcus aureus	3 "
Colon bacillus	1 case.
Staphylococci and streptococci	1 "
Streptococcus and others	1 "
	19 cases.

No material difference was noted in the duration of the above cases, except in those in which the pneumococcus was found; three (3) of the cases of pneumococcus infection lived respectively four, four and one-half, and five months, the other two living six and seven weeks respectively. In the case in which the colon bacillus was found in the heart and valves, the same organism was found in pure culture in the spleen, liver, and kidneys. It is fair to presume that this organism may have been the cause of the endocarditis, as the infectious disease apparently arose in a peri-proctal abscess, thereby allowing a good opportunity for this organism to invade the general circulation from the rectum. (Hitschman and Michel report in the Wiener Klin. Woch. 1896, No. 18, a similar case of malignant endocarditis in which the colon bacillus was found in pure culture.) In five cases organisms were found on microscopic examination where no cultures were successful.

Pneumococcus	1 case.
Bacilli and cocci	2 cases.
Gonococci	2 "

The cases in which the gonococci were found are of interest as adding two more to the ever-increasing list of cases in which gonococci have been found in endocarditis following directly upon gonorrhœa. In the third case of gonorrhœa streptococci were found.

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SIXTEEN CASES WITHOUT AUTOPSY.

A careful review of all the symptoms in this series of cases in which no autopsy was obtained fails to show any reason to doubt the correctness of the diagnosis. The main interest in these cases centres in a consideration of the symptoms noted which lead to the diagnosis.

In two of the cases rheumatism was present several years before the onset of the acute disease, the others presenting no history of any illness bearing on the etiology of the malignant endocarditis, except in one instance in which the only disease was gonorrhœa six months before the onset of the endocarditis, the history of which follows:

A man twenty years of age had never been sick. Two weeks before entrance to the hospital he had headache, chills, vomiting, and epistaxis, being confined to the bed; in the hospital he had considerable cough, irregular fever, chills, and delirium. Widal reaction negative on three occasions; leucocytes, 29,400 and 28,600. At the apex was a loud systolic murmur; the spleen was increased in size. He died after three weeks; the frequent examination for the Widal reaction shows that typhoid fever was at first strongly suspected, though the final clinical diagnosis was gonorrhœal endocarditis.

They were sick between one and six weeks before admission to the hospital.

The first symptoms complained of were:

Weakness and vomiting	4 cases.
Headache, fever, chills, and joint pains	4 "
Headache and fever	3 "
Weakness and cough	2 "
Polyarticular pain	2 "
Fever and chills	1 case.

This list of complex, varied symptoms is comparable to the early symptoms in the first series of cases.

Delirium was present in all the cases, and stupor was so marked in two cases that some cerebral disease was suspected as evidenced by the statement that lumbar puncture was performed.

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Cough was a feature in fourteen cases. Chills were noted in nine cases and in several of the cases recurred frequently.

Petechiæ in six cases.

In all the cases the temperature was very irregular and high, except in two.

In thirteen a leucocyte count was made; in one case the highest of two counts was 7,600, but in all the others it was over 10,000. On an average the leucocyte count was higher than in the previous series, in two cases being over 30,000, and in one case 40,600.

Judging from the clinical data at hand the heart lesions may be estimated as follows:

Aortic valve	2 cases.
Aortic and mitral	3 "
Mitral	6 "
Mitral and pulmonic	2 "
Pulmonic	2 "

In one case no report is given as to the heart since admission, and at that time the report was negative. In three cases no murmur was recognized when the patients entered the hospital, and in three cases there was a marked change in the character of the murmur while the patient was under observation.

In nine cases the spleen was enlarged. Two of the cases are described as "septic" in appearance. The history of the cases shows that typhoid fever, pulmonary tuberculosis, malaria and cerebro-spinal meningitis were considered in making the differential diagnosis.

In two cases cerebral emboli or abscesses developed, as shown by the appearance of localized paralysis. In the case considered as possibly cerebro-spinal paralysis, petechiæ appeared shortly before death, and served to finally confirm the diagnosis.

A consideration of the above-described fifty-nine cases suggests the following data as of importance in the differential diagnosis of malignant endocarditis.

Previous history. — Evidence of some heart lesion in the past, especially if there has recently been some acute sup-

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purative disease or gonorrhœa which might serve as a focus for the infection of the general circulation with micro-organisms.

Early symptoms. — Fever, chills, malaise, joint pains, vomiting, cough and weakness.

Course of the disease. — Irregular fever, chills, cough, delirium, stupor, petechiæ; of especial importance is the appearance of any clinical phenomena suggestive of emboli, as petechiæ or localized paralysis. Infarction of the kidney rarely, if ever, gives rise to changes in the urine which can be reasonably diagnosed from similar conditions dependent upon degenerations secondary to any febrile process.

Leucocytosis. — Without the presence of leucocytosis the disease cannot be diagnosed with certainty, though it may be absent in the late stages, as in advanced cases of septic peritonitis, or in fatal cases of pneumonia. In only one case of the present series were the leucocytes normal, and in this instance no autopsy was obtained.

In making the differential diagnosis, the following diseases are to be considered:

Typhoid fever, malaria, tuberculosis, acute pulmonary diseases, meningitis, acute septicæmia without localized disease in the heart, renal disease, and, lastly, suppurative processes about the liver, as jaundice, may be seen in malignant endocarditis.

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V.

LYMPHO-SARCOMA OF RIGHT LOBE OF THYROID GLAND — DYSPHAGIA — DYSPNŒA — TRACHEOTOMY — REMOVAL OF TUMOR — RECURRENT DYSPNŒA — TRACHEO-ŒSOPHAGEAL FISTULA — FINAL CLOSURE — RECOVERY.

By David W. Cheever, M.D.

May 27, 1899. Mrs. ——, of middle age, good health and the mother of a family, after a severe cold, which rendered her speechless for some days, first perceived that her collars were too tight, and that a small bunch had appeared on the right side of the neck, about the location of the right lobe of the thyroid gland. This was speedily followed by difficulty in swallowing, so that for three weeks she gave up eating solids. About the middle of July the obstruction changed from the gullet to the windpipe.

Asthmatic dyspnœa, stridulous breathing, croup and noisy respiration with great distress, came on.

By August this was much worse, entailing sitting up in bed and at an open window, in the night, and having severe paroxysms.

Up to this date (August, 1899) she had been given large doses of the iodide of potash, and later, thyroid extract. The tumor slowly increased, it was as large as a pullet's egg, firm, rounded, not pulsatile, moving with the larynx. It was thought to be a bronchocele.

August 25. The patient came up from the seaside to seek further advice, as the dyspnœa was intolerable.

The lungs were clear, except a few coarse bronchial râles. Respiration and pulse hurried, surface sweating, eyes rather

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prominent, a wheezing breathing, with severe stridulous attacks, tumor unchanged, general health good.

She was taken to the City Hospital for operation.

The plan I mapped out was to give ether moderately; to do a tracheotomy; then to etherize fully, and attempt the dissection and removal of the tumor, which evidently dipped down below the sternum.

August 29. The neck was cleansed, and ether given; intense dyspnœa and congestion were induced; ether was abandoned, cocaine injected under the skin of the neck, and tracheotomy done. The trachea was pushed to the left by the tumor.

The patient bore the operation with great fortitude, but was much exhausted, and I decided to wait three days before proceeding farther.

The patient now had good sleep, quiet nights, and took an abundance of liquid food.

September 1. She was in good condition, rested, calm, no dyspnœa. Ether was fully given with ease, and the operation to remove the tumor proceeded with. A crucial incision revealed a soft growth penetrating into the sheath of the large vessels and extending down, between the trachea and œsophagus, below the clavicle and sternum.

This having been as completely removed as practicable a gauze drain was inserted, and the rest of the wound closed with catgut.

The tumor was rather soft, and was pronounced to be a lympho-sarcoma by Dr. Councilman.

No temperatures followed the operation; breathing easy.

On the fourth day there was pus, and irrigation followed.

No other symptoms. At the end of ten days the tube was taken out, but soon had to be replaced. Two weeks later the same. Three and one-half weeks the same. Croup, stridor, distress, asthma on removing tube. The patient was submissive, and kept the tube out an hour or two at a time, but in vain.

September 25. Wound all healed, and was sent home, with tube in. No symptoms. Seems well.

The tube remained in eight weeks. There was no apparent

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irritation about the tracheal incision, or in swallowing. Over and over again the patient tried to sit up, to lie down, to sleep, without the tube, but in vain. It remained in until October 24.

About October 11. Fever and chill and restlessness. October 18, in the night, hemorrhage and a flow of pus.

Patient declared that when she swallowed it went into the bronchial tubes, or trachea. No one believed her. But on going out to see her I saw a big swallow of milk pour out of the tube, and a severe coughing paroxysm follow. I took the tube out at once, and permanently. No dyspnoea then or after.

October 23. Rectal feeding was begun, and continued three weeks and two days. Nothing swallowed for three weeks. Then water given, which still produced strangling cough.

November 15. I passed a long, soft catheter past the leak, and fed the patient. Feeding by the tube was kept up for twelve weeks. The nurse learned to pass the tube, but the patient soon took it out of her hands, and passed it herself. When she was at the worst Dr. Farlow saw her with me, and examined the throat with the mirror. He could not see the fistula. He could see the vocal cords. The one on the side toward the tumor acted imperfectly. Dr. Reid, of Newton, rendered kind and valuable assistance in taking care of the nutrition of the patient.

The trachea hole healed. There was *no dyspnoea;* patient grew fat and strong with tube feeding.

December 25. She came to the Christmas table and leaning to one side she found herself able to swallow some food naturally.

From December 25 to February 10. Natural swallowing gradually took the place of tube feeding. On February 10 the feeding tube was abandoned.

The middle of March, patient thinks the opening closed. It was thus an open fistula, from gullet to trachea, five months.

In June, 1900, Mrs. C—— was well, voice, breathing, swallowing.

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At the top of the vertical incision, made to remove the tumor, there was a little hard kernel. I advised its removal. She took ether, and had this and neighboring tissue removed.

June 16. It healed promptly, and the ether made no trouble; nor did the ether vomiting.

Dr. Mallory found no evidence of recurrence in the kernel removed, which was probably a suture irritation, and a little pus.

July, 1900. Mrs. C—— is an able-bodied woman. No symptoms. What was the cause of the dyspnoea with the tube removed?

Evidently some inflammatory tumefaction from September 10 to October 18. What caused the abscess and perforation? If tube pressure, why was this not relieved by removal? Does tracheo-pharyngeal sinus heal? This one did, contrary to my expectation.

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VI.

A REPRESENTATIVE FOUR MONTHS' SERVICE.

By Francis Sedgwick Watson, M.D.

The following is a brief summary of the work done in the third surgical service of the Boston City Hospital while in charge of the writer, assisted by Dr. Edwin W. Dwight, during the four months, December, 1899, to April 1, 1900, exclusive of the cases — for the most part fractures and inoperable malignant growths — in which no surgical operations were performed.

The total number of operations done in these four months was one hundred and forty-four — 144. Of these, ninety-three were capital. To those which were not, no particular interest attaches, and they are therefore simply enumerated for the sake of recording their nature in a general way. They included the following: Fistula in ano, abscesses of various parts, ingrowing toe-nail, needles and other foreign bodies in hands or feet, compound fractures and minor amputations for traumatic lesions, hemorrhoids, removal of sequestra, necrotic bone, buboes, epulis, cancer of lip, etc.

The ninety-three capital operations may be classified as follows: Abdominal, fifty-one cases; cases involving operations upon the bony structures, eleven; genito-urinary, not included in the abdominal cases, sixteen; tumors not abdominal, eleven; miscellaneous, four.

1. *Abdominal.*

(*a*) Operations involving opening of the peritoneal cavity,	44
(*b*) Operations not involving opening of the peritoneal cavity	7
Total	51

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(*a*) Acute appendicitis (general peritonitis when operated 5)	13
Operated in the interval	1
Acute pyosalpynx (with general peritonitis when operated 3)	3
Sub-acute pyosalpynx	1
Ventral fixation of retroflexed and adherent uterus	2
Miscarriage (with general peritonitis 2)	2
Hysterectomy (for uterine fibroid)	1
Suture of ruptured bladder (intraperitoneal)	1
Splenectomy for ruptured spleen	1
Gastrolysis for relief of gastralgia and invalidism due to adhesions	1
Resection of lower end of stomach and pylorus (cancer)	1
Perforating gastric ulcer (general peritonitis when operated 2)	2
Right inguinal colotomy for relief of symptoms due to rectal cancer	1
Exploratory laparotomies (cancer of uterus)	2
For intra-abdominal malignant growth	1
For acute abdominal symptoms simulating peritonitis	1
Laparotomy and drainage (tubercular peritonitis)	1
For abscess of the liver and general peritonitis	1
For abscess of the abdominal wall and sinus communicating with the peritoneal cavity caused by penetration of the stomach or intestine by a bristle two inches in length,	1
Closure of abdominal sinus remaining after an operation for salpingitis	1
Lumbo-abdominal exploration of kidney (symptoms simulating calculus)	1
Radical cure for hernia (inguinal 4, vertral 1)	5
	44
(*b*) Strangulated femoral hernia	2
Suprapubic cystomy (tubercul. cystitis (1); prostatectomy (1); strict (1)	3
Lumbar and abdominal drainage abscess of Pott's disease,	2
	51
2. *Cases Involving Operations on Bony Structures*	11
Trephining the skull, fracture of base (2), compound not of base (1)	3
Trephining the skull for removal of septic thrombus from cavernous sinus	1
Excision of knee-joint (tubercular disease)	1

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Resection of ribs (empyema)	1
Resection of both bones of forearm (compound fractures),	1
Resection of ulna (compound fracture)	2
Wiring of fractured (simple) patella, successful	2

Genito-Urinary Operations.

Perineal prostatectomy	1
Internal urethrotomy	2
External perineal urethrotomy (urinary extravasation in all)	4
Combined internal and external urethrotomy	2
Szyminowski's operation for closure of perineo urethral fistula	1
Radical cure of hydrocele by excision of the sac	2
Removal of testical for tubercular disease	2
Excision of large benign papilloma of the groin	1
Litholapaxy	1

Tumors.

Cancer (of breast (1), recurrent ditto (1), rec. of axilla (1),	3
Cancer of lower jaw resection	1
Cancer of tonsil, excision through the neck	1
Sarcoma of the axilla	1
Sarcoma of scapula	1
Tubercular glands of the neck (extensive excisions)	4

Miscellaneous.

Popliteal aneurism (distal and proximal ligature of vessel),	1
Amputation at shoulder joint (for injury)	1
Reduction of dorsal dislocation of hip	1
Penetrating bullet wound of thorax (ball passing through both lungs)	1
Total	93

Of the above ninety-three operations death resulted in the following cases :

Appendicitis (14 cases), general peritonitis (5), — deaths.	7
Acute pyosalpynx (4 cases) (general peritonitis in 3), — deaths	3
Miscarriage (general peritonitis)	1
Suture intra perit. rupture of bladder (pneumonia)	1
Splenectomy (shock)	1
Resection of stomach (shock)	1
Perforating gastric ulcer (general peritonitis in both)	2
Strangulated femoral hernia (tardy operation)	2
Trephining for fracture of base	2

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Trephining for removal of thrombus from cavernous sinous (sepsis)	1
Perineal prostatectomy (urinary suppression)	1
External perineal urethrotomy (extravasation and sepsis)	1
Amputation of shoulder-joint (septic when operated)	1

Total number of operations, 144. Total number of deaths, 24
Mortality percentage, 16% plus.

Of these twenty-four deaths the larger part were practicably inevitable, from the nature of the cases or their condition when operated. The operations were done when this was true because of the custom which prevails with us of operating in all cases in which so doing offers the patient a better chance of life, no matter how small that chance may seem, than not operating. This practice is continued because of the cases that are from time to time saved by operation in what appear to be at the moment almost hopeless conditions.

A glance at the nature of the fatal cases will show how small the chances of saving them were. Thus general peritonitis was present in eleven of the sixteen fatal abdominal cases, at the time of operation, and one other, appendicitis, was of the fulminating gangrenous form, in which the process involved the lower end of the caecum as well as the appendix. Death resulted from double pneumonia in the case of intraperitoneal rupture of the bladder, and was present when the operation was done.

Splenectomy was done for ruptured spleen for the sake of the faint chance that operation offered of saving the patient, death being inevitable otherwise.

Both cases of strangulated hernia were in old and feeble persons, and one of them delayed too long before coming to the hospital.

Trephining for fracture of the base of the skull, resulting fatally, needs no comment.

The case of trombosis of the cavernous sinus was profoundly septic when the skull was trephined, and the chance of saving the patient of the smallest.

There remain one case of appendicitis, the resection of the stomach for cancer, amputation of the shoulder joint, external perineal urethrotomy for stricture and extravasation of urine,

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and perineal prostatectomy, five in all, which should to all appearance have proved successful, the conditions being, on the whole, favorable for recovery.

Some of the elements that are influential in the mortality records of large public institutions are the following: Frequent changes of assistants, especially nurses and ward-masters, and delay in bringing patients to the hospital, but foremost is the large proportion of emergency cases and the fact that there can be no selection of cases for operation with a view to favorable results, which can be done in smaller and private institutions.

Two details of some interest in this connection may be noted incidentally, the first is that the mortality percentages of the two other surgical services of the hospital for the same months are almost exactly the same as that of this series, the variation of the three being only between 15 per cent. plus and 16 per cent. The nature of the cases and the conditions under which the operations were done were similar in all the services. The number of operators is altogether eight or nine, and the total number of cases operated by them was 473 in the four winter months. The similiarity of the results is ascribed by the writer to the levelling effect of modern surgical methods — aseptic system — which, as compared with former times, may be credited with a relatively larger, and the operator a relatively smaller measure of success.

An example of the fallacy that is frequent in drawing inferences from an inconsiderable number of instances is furnished in this series by the fourteen cases of appendicitis, which has a mortality of fifty per cent. When one looks back over the records of preceding numbers of consecutive cases performed under similar conditions by the same operators, one finds one series of fourteen with one death, another with three, another with none, and so on.

It may be appropriate to refer to our experience of the value of two measures which have been in vogue of late years, namely the use of subcutaneous injections of large quantities of sterile saline solution to overcome shock during operations, and second, of leaving the abdomen full of the

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same solution at the end of certain intraperitoneal operations and of elevating the foot of the bed afterwards as a means of diminishing the dosage of sepsis and promoting the withdrawal by absorption of the septic elements from the peritoneum. Of the value of the former we are strongly convinced. The practice of the second has been largely abandoned because of our failure to be convinced of its usefulness.

Amongst the ninety-three capital operations are a few that seem worthy to be recorded in detail. They are the following:

1 and 2. Two cases of perforating ulcer of the stomach, one of which was associated with an hour-glass contraction. Suture of the perforation.

3. Gastrolysis for the relief of gastralgia and disability of the patient, due to adhesions between stomach and gall bladder originating in a former gastric ulcer.

4. Intraperitoneal rupture of the bladder; suture.

5. Excision of the tonsil through the neck, for cancerous disease.

The above were performed by the writer, those which follow, by Dr. Edwin W. Dwight.

6. Splenectomy for ruptured spleen.

7. Trephining for removal of septic thrombus from the cavernous sinus.

8. General peritonitis, with recovery following operation:

Case 1. — Perforating gastric ulcer, in connection with an hour-glass contraction of the stomach, due to adhesions from an old ulcer. General peritonitis present at time of operation, which was undertaken eleven hours after appearance of symptoms indicating perforation. Suture of perforation. Death from general peritonitis four days later.

The patient was a woman, aged thirty. Duration of symptoms eleven years. Symptoms. Hematemesis rather frequent at first, occasional since, twice within the past year, not abundant. From the first, burning, pain and tenderness in epigastrium, coming on and most marked immediately after eating. Vomiting in connection with the attacks of hematemesis, otherwise none. But little loss of weight or strength until last year, since then they have been marked.

Eleven hours prior to operation she was suddenly seized with severe epigastric pain, most marked under border of ribs on the left

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side, and extending upward beneath sternum. Vomited — no blood with the vomitus — pain increased. On entrance, temperature 99.5, pulse, 110, regular, and of fair strength. Abdomen distended, abdominal muscles rigid; tympanites. Liver dulness, but slightly diminished. No localized tenderness. Pain is now most marked in right iliac fossa and beneath lower end of sternum. Respiration shallow and entirely thoracic. Marked nausea, and prostration beginning to be pronounced.

Operation, February 19, 1900. — Time, 1 hour. The abdomen was opened by a median incision extending downward from the tip of the ensiform cartilage for four inches. A dense mass of adhesions attaching the stomach to the parietal peritoneum through the upper two-thirds of this incision was encountered; the cut was prolonged and the peritoneal cavity entered below this point. The adhesions were surrounded by gauze before detaching them. There was a small quantity of turbid fluid and some stomach contents in the abdominal cavity, extending downward along the flanks to the pelvis. General peritonitis was present. The adhesions were detached from the abdominal wall. They extended from the anterior surface of the stomach and its lesser curvature to the parietal peritoneum in front, then passed over to the left lobe of the liver and the gall bladder, while another portion extended from the upper third of the lesser curvature downward to the pylorus and first two inches of the duodenum drawing the latter upward on to the lesser curvature and there binding it firmly.

On separating the adhesions attaching the lesser curvature to the liver the perforation, which admitted the tip of the forefinger, was found. It was surrounded by a thick zone of dense connective tissue, and buried in the mass of adhesions already described. It was situated two inches above the displaced pylorus (about midway on the lesser curvature had the stomach had its normal form) and on the anterior surface of the organ an inch below it. Through the perforation the stomach contents were escaping, and had travelled downward through the abdominal cavity as already described. There was no escape of gas at any time during the operation. The perforated part of the stomach was brought out of the wound and the opening united by a row of interrupted silk sutures, reinforced by others passed outside of the first line in some places. The length of this line of sutures was quite two and a half inches. The edges of the ulcer were turned well in by the sutures. A free counter-opening was made in the lower part of the abdomen, and gauze wick drains were led from the loins, from the site of the perforation and from the pelvis through this opening and a small part of the upper abdominal wound which was left open for the purpose. The whole peritoneal cavity was washed out with hot salt solution before placing the drains. During the operation a pint of saline solution was injected subcutaneously, the patient's condition being at the moment

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critical; thereafter she rallied and was at the end decidedly better than at the beginning of the operation. No food was given by mouth afterward, nutrient enemata being used instead. The patient's progress was to all appearance satisfactory up to the end of the second day when she began to vomit occasionally. Temperature rose, prostration became increasingly marked and she died at the end of the third day.

Autopsy. (Only the examination of the peritoneal cavity was allowed) General peritonitis. An hour-glass contraction of the stomach was found to be present, produced by the adhesions arising from old gastric ulcers, and associated localized peritoneal inflammations corresponding to them. The density and extent of these connective tissue masses were notable. The middle portion of the greater curvature was drawn upward toward the lesser, and the lumen of the stomach at this point was such as to admit with difficulty the forefinger; the narrowing extended for a distance of nearly two inches, and the stomach walls throughout this area were hard, greatly thickened, and rigid from the deposit of connective tissue in their muscular coats and the peritoneal investment. The perforation had occurred just at the cardiac end of the narrowed and indurated part of the organ. The condition of the stomach and the perforation are shown in the accompanying figure.

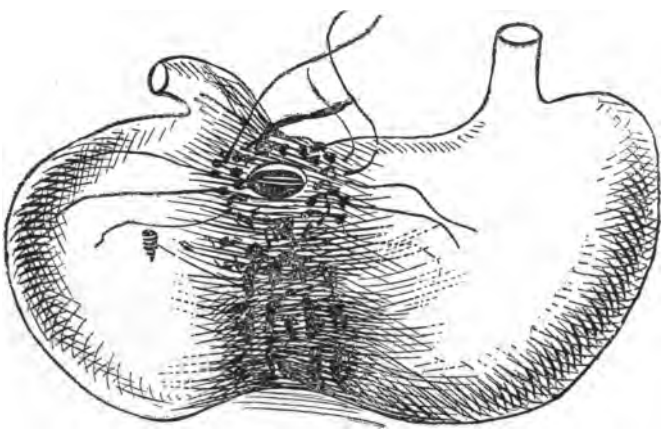

FIG. 1. — Perforating gastric ulcer in connection with hour-glass contraction of the stomach.

PERFORATING ULCER OF THE STOMACH.

General Peritonitis — Suture of the Perforation — Death on the Fourth Day from General Peritonitis — Operation Undertaken Twenty-four Hours after first Appearance of Symptoms of Perforation.

A man, age sixty-two. No gastric symptoms prior to three weeks before entering the hospital. Since then slight pain and distress in the upper part of the abdomen, not very clearly localized. Twenty-four

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hours ago a sudden attack of violent epigastric pain, accompanied by frequent vomiting. No blood in vomitus. A natural movement of the bowels on the morning of the same day. No blood in the stool. When admitted pain had become general throughout the abdomen, and most marked just above the symphisis pubis. Condition at this time as follows: Marked pallor; lies on right side, with knees flexed; pulse variable in strength, at times very weak, 90; temperature, 99; abdominal muscles, rigid; severe abdominal pain, not localized; marked tenderness on pressure all over the abdomen, somewhat more decided in epigastrium; no abdominal distention; liver dulness normal.

Operation, December 4, 1899. — Time occupied, fifty minutes.

Median four-inch laparotomy incision, beginning one inch below tip of ensiform cartilage, subsequently extended at right angles from its lower end, half-way through the right rectus muscle.

A large quantity of stomach contents escaped at once on opening the peritoneum. The stomach was free from adhesions, and was easily lifted up into the wound. A perforating ulcer, admitting tip of the little finger, was situated just above the junction of the pylorus and duodenum, on the posterior surface of the former. There was a pronounced general peritonitis. The perforation was closed by a single row of interrupted silk sutures, reinforced at one or two points, the edges of the perforation being inverted in so doing. The sutures were passed through the muscular layer and the submucosa.

A counter opening was made in the lower part of the abdomen, and the peritoneal cavity was thoroughly irrigated during the progress of the operation with hot saline solution. Stomach contents had descended into the pelvis. Gauze wick drainage was placed in the pelvis and loins, and in the region of the perforation, and led out through the abdominal wounds.

The patient did very well, indeed, until the third day, when he began to vomit, had moderate abdominal distention, pulse became rapid and weaker, and he died on the fifth day. The autopsy showed death to be due to septic general peritonitis. The abdominal cavity was seen to have been well drained, and the stomach suture to have held perfectly.

GASTRALGIA AND DISABILITY FROM ADHESIONS BETWEEN THE STOMACH AND GALL BLADDER DUE TO FORMER GASTRIC ULCER — GASTROLYSIS.

Woman of thirty-five, for five years burning sensation in epigastrium, sense of oppression and distention aggravated by food. One year ago moderate hematemesis, a few days later severe hemorrhage, she then entered the hospital in the service of Dr. George B. Shattuck, and, under treatment by rectal enemata, rest in bed and bland diet,

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she recovered gradually, and continued fairly well for a year. Two months ago she began to lose weight and strength, and suffered from distressing gastric symptoms, similar to those on the former occasion. She again improved under the same treatment, but believing that relapse was probable, surgical operation was advised. The woman was, at that time, in good general condition, there had been no hematemesis since the first attack, but she still had a good deal of epigastric pain and distress. Free hydrochloric acid was present in the stomach contents.

Operation, Feb. 3, 1900. — Duration, forty minutes. Abdomen opened by median four-inch incision extending downward from the tip of the ensiform cartilage. Stomach was drawn into the wound readily, it appeared to be normal except for an area about the size of a half-dollar upon its upper margin close to the line of insertion of the lesser omentum, at which point there was a delicate cicatrix from which extended a band of slight adhesions which attached that part of the stomach wall to the upper and lateral aspect of the gall bladder. This band was ligated close to the stomach on one side and to the gall bladder on the other with catgut, and removed. There was no bleeding, and no raw surface was left at either end. The peritoneum was closed with one row of fine silk sutures and the abdominal wound with another of catgut. After the first twenty-four hours the patient experienced entire relief of all symptoms, and made an uninterrupted recovery. She resumed her work a short time after her three weeks in the hospital, and has had absolutely no trouble since, six months.

INTRAPERITONEAL RUPTURE OF THE BLADDER. LAPAROTOMY SUTURE OF BLADDER WOUND, DEATH FROM DOUBLE PNEUMONIA TWENTY-FOUR HOURS LATER.

The patient, a strong healthy man of forty years, received, during a drunken brawl, a violent kick in the lower part of the abdomen. There was no evidence of shock at the moment, and he soon fell into a drunken stupor. On awakening twelve hours later he felt severe abdominal pain, and was taken at once to the hospital. He had passed no urine since the accident. A catheter was passed and withdrew three ounces of bloody urine. Ten ounces of saline solution were injected, but five of which — blood stained — returned through the catheter.

The general condition of the patient was good. Pulse ninety and of fair strength. Temperature, 99.6 F. The abdomen slightly distended, and tenderness over the lower part, and muscular rigidity were marked. Percussion dull in the flanks, tympanic in front. Line of dulness changes on turning patient from back to side.

Operation. — Sixteen hours after injury duration fifty minutes. Abdomen opened by median incision, extending upward from

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symphisis pubis. The abdomen contained about three quarts of bloody urine and serum, which was free in the abdominal cavity. The latter was thoroughly washed out with saline solution, and then dried. Patient put in Trendelendburg position. The bladder was found to have a ragged rent, two and a half inches in length, an inch below the fundus on the posterior surface. The wound extended through all the coats of the viscus, and involved at either end the peritoneal investment for half an inch beyond the bladder wound itself. The wound was sutured with fine silk. The union tested by full injection of the bladder through the catheter and found to be tight. Abdominal wound closed except at its lowest angle, through which it was drained by glass tube surrounded by sterile gauze wicks.

There was no peritonitis at time of operation.

Patient died thirty-six hours later. An autopsy showed a double acute lobar pneumonia which undoubtedly had begun prior to operation. There was no peritonitis, whatever.

EXCISION OF THE TONSIL THROUGH THE NECK FOR CANCER. JANUARY 12, 1900.

The patient, a man aged thirty-nine, in good health until five weeks ago. At that time he had what he thought was an ordinary sore throat. This persisted, and ten days later he was seen by Dr. George A. Leland, who removed a small bit of a growth which occupied the right tonsil, and found it to be cancer.

Operation. — A cresentic incision, its concavity toward the lower jaw was made in the neck from a point about an inch outside the lobe of the ear, and extending parallel with the lower jaw to a point opposite the mental foramen. The skin, platysma myoides and the external jugular vein were divided in the line of the incision. The parotid gland was larger than normal, and its lower end was slightly cut. The submaxillary gland was exposed, the facial artery and vein ligated by double ligature near the external carotid, and divided.

The external carotid, the posterior belly of the digastric, the stylohyoid, and the styloglossus muscles were drawn backward and outward toward the sternocleidomastoid muscle and held there by blunt retractors. The glossopharyngeal nerve and two of the lower and smaller branches of the facial nerve were divided in the operation. The posterior fibres of the hyoglossus and the superior constrictor of the pharynx were separated by a blunt dissector exposing the fascia covering the growth. While doing this three rather small veins, apparently entering the internal jugular, were divided, and severe hemorrhage resulted, owing to their being involved in the friable tissue of the growth, and the patient's condition became serious before they could be secured. When this was done the growth was removed by separating it from the pillars of the fauces and the adja-

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she[illegible] structures by the tip of the finger and the scissors. It extended downward to the level of the hyoid bone, and involved the posterior wall of the pharynx, but not the floor of the mouth nor the base of the tongue. All but a very small part of the growth was successfully removed, the part left behind involved so deeply the posterior pharyngeal wall as to make its removal impossible. The outer wound was closed except at its lower angle. Patient nourished for a week by rectal enemata, the throat was washed out frequently with peroxide of hydrogen. The patient made a good recovery from the operation, though a small fistula remained. He died about three months later from extension of the disease.

CASES OPERATED BY DR. DWIGHT.

During the months of December, January, February, and March, I personally operated upon seven cases of acute general purulent peritonitis at the hospital. This does not include any case in which the general peritoneal cavity was not bathed in purulent fluid.

The cases were all acutely sick, and were operated upon as emergencies. In none of the cases would delay have been justified, and none of them were to my mind in condition to stand a prolonged operation.

The operations were undertaken with the idea of relieving sepsis, and the method employed was that which in my opinion would most effectively reduce the dose with the least interference with the general condition. The patient was lightly etherized, rarely if at all passing the stage of primary anæsthesia. A short incision was made for two reasons, to avoid the necessity for sutures, and the probability of protrusion of the intestines. A large flushing tube, some ten or twelve inches long, was used, and the peritoneal cavity thoroughly flushed out with hot salt solution, this flushing being continued until the fluid from all parts of the cavity was entirely clear, or until the condition of the patient warned me to stop. During the flushing the cause of the peritonitis was sought for, and if easily found, as was usually the case, it was removed.

Drainage was by means of gauze strips, three or four of them leading to various parts of the cavity, which were removed on the second, third, and fourth days. Stimulants

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were used freely if indicated, and feeding either by rectum or mouth began within a few hours of the operation.

In other cases, which showed evidence of pocketing of pus after the first operation I have repeated it, and in several cases have, I believe, saved life by so doing. It so happened that in none of these cases was this done.

The following cases are reported in the most abbreviated manner, the duration given being that of the peritonitis, not of the whole attack:

Case 1. — Following miscarriage, three days' duration; lived four days, gradually increasing distention, vomiting, delirium. *Death.*

Case 2. — Following appendicitis, duration four days; lived three days; first day improved, then increasing distention and vomiting. *Death.*

Case 3. — Following appendicitis, three days' duration; lived two days; increasing distention, vomiting, etc. *Death.*

Case 4. — Following appendicitis, thirty-six hours' duration; steady improvement, with no complication or untoward symptom after the first twenty-four hours. *Recovery.*

Case 5. — Following appendicitis, thirty-six hours' duration; steady improvement; no complications or untoward symptoms. *Recovery.*

Case 6. — Following appendicitis, forty-eight hours' duration; steady improvement, with no complications or untoward symptoms. *Recovery.*

Case 7. — Following abscess of liver, twenty hours' duration; steady improvement for thirteen days, then fever, vomiting, and formation of parotid abscess, temperature normal again on twentieth day, and then steady improvement. *Recovery.*

The three first cases, those in which death followed, were those in which the peritonitis was of the longest duration. In one ("Case 2") the condition of the patient was such that the appendix was not removed, and the flushing was much less thorough than in the others. It is my opinion that life was prolonged in all of them by the operation, and the consequent reduction in sepsis. While it is, perhaps, probable that had an autopsy been done pockets of pus would have been found, the impression given was that death was due rather to the effect than the presence of sepsis. Had it been otherwise I should have repeated the flushing.

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The result in these cases are entirely in accord with those obtained before and since, and taken together tend to demonstrate several points of interest in connection with the subject.

That this operation may be done on patients in a very critical condition, and without tending to shorten life even in the most severe.

That with proper etherization, the use of hot solutions, and practically no exposure, either of the patient or their viscera, the tendency is towards a prolongation of life even if the result in the end be fatal.

SPLENECTOMY.

Male, thirty-five years, teamster. About two hours before entrance to the hospital, while unloading a barrel of beer, it fell from the "skids," striking him on the left side, and rolling over that side and back.

Physical Examination. — Well developed and muscular man, pale and in condition of considerable "shock"; a little dried blood about nostril; *respiration*, hurried and shallow; *pulse*, rapid, weak, but regular; *abdomen*, slightly distended — general muscular spasm; rigidity most marked on the left side; dulness in both flanks, especially in the left.

He was put in bed with heaters and blankets, and carefully watched for the next hour, at the end of which he had distinctly lost ground. His pulse and respiration were more rapid, and he was restless and thirsty.

Operation. — Patient was lightly etherized, abdomen hurriedly cleansed, and an incision about five inches long in the left linea semi-lunaris, beginning at the costal margin, was made. On opening the peritoneal cavity there was an escape of a large quantity of fluid and clotted blood.

The spleen was found badly lacerated, and after its vessels had been clamped and tied it was removed. No other viscera were found to be injured. The abdomen was flushed out with salt solution, and the wound closed with no attempt at removal of the solution.

The patient was under ether about twenty minutes, and during that time he did not fail noticeably. His condition grew worse during the next hour, and, notwithstanding stimulation, he steadily failed, and died about five hours after the operation.

There was unfortunately no autopsy allowed, so that the exact abdominal condition could not be ascertained, but I was satisfied that death was due to the hemorrhage previous to the operation, and not after it.

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SEPTIC THROMBOSIS OF THE CAVERNOUS SINUS — OPERATION, DEATH.

The patient was a man forty years of age, and a carpenter. About two weeks previous to his entrance to the hospital he noticed a small abscess on the upper right cheek, which was treated by poulticing. The inflammation extended, and it was opened into the mouth, and poulticing continued. The inflammation still continued to extend, and he was admitted to the hospital for further operation.

Physical Examination. — Temperature, 103.5; pulse, 120; right cheek swollen, hot, and reddened; near the naso-labial fold there is a small opening from which a drop of pus may be pressed; about the middle of lower jaw is a localized area of induration which extends upward on the cheek, to the eye.

Eyes. — An examination of the eyes was made by Dr. Jack, who reported as follows: Double exophthalmos, most marked on the right which protruded between the lids. O. D., immobile. O. S., slight motion in all directions.

Cornea. — O. D. shows small superficial ulcer.

Pupils. — Dilated and do not react to light or accommodation.

Fundus. — O. S. Veins more dilated than normal. O. D. shows blurring of edges of disk.

V. O. D. questionable sensation of light. V. O. S. — Fingers at two feet.

Dr. Jack considered that there was a thrombosis of the cavernous sinus on each side, and that the prognosis was very grave, if not absolutely bad. The next day he was unconscious, and the exophthalmos had increased on both sides. On the following day the hospital note says "Condition grows steadily worse. There is now some stiffness of the muscles of the neck. Passing urine and feaces involuntarily. Can be partially roused, but consciousness is doubtful."

Dr. Edwin E. Jack reports as to the diagnosis as follows:

"The diagnosis of sinus-thrombosis was based partly on the fact that the exophthalmia was double, it being easier for the sepsis to spread from one caverenous sinus to the other through the circular sinus, than for the second orbit to develop cellulitis, either directly from the first or from the original sources of infection. There was, too, a great amount of œdema of lids and cheek, suggesting by its intensity sinus trouble. I do not now remember whether there was mastoid œdema or not, but if there was, it was one important point in favor of sinus thrombosis. The fundus could be seen but very imperfectly through the hazy, macerated cornea, but dilated and tortuous veins could be made out.

"There was, of course, the possibility that the sinus was involved secondarily to cellulitus of the orbit."

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Considering the condition of the patient it was thought that an operation for the relief of sepsis and post-orbital pressure was warranted, although it held out little, if any, hope of life. The gravity of the case was explained to the friends of the patient, and with their consent the operation was performed.

Operation. — A curved incision, which allowed of the turning down of a flap, including the skin, temporal muscle, and periosteum, was made exposing the anterior portion of the squamous portion of the temporal bone.

A trephine opening was made just above the zygoma, entering the middle fossa about three-fourths of an inch back of its anterior tip. The finger was introduced, and when the tip of the temporal lobe had been pressed backward and upward the cavernous sinus could be readily detected by the touch. A small knife was introduced along the finger and the sinus opened. When the finger was partially removed there was a considerable gush of dark, semi-clotted blood.

A strip of gauze was carried in with long forceps and controlled the hemorrhage easily.

The scalp wound was closed with four stitches, and a narrow strip of gauze left in for drainage.

From the first incision to the last stitch but fifteen minutes elapsed, and the patient's condition was no worse at the end than it had been at the beginning.

The relief to the post-orbital pressure was immediate, and within half an hour the exopthhalmos had to a great extent disappeared. The general condition did not improve, and he died six hours after the operation.

This operation is, I believe, unique, and in performing it I was impressed with three things, viz., the ease and rapidity with which it was accomplished, the easy control of hemorrhage, and its immediate effect upon the post-orbital pressure.

In the future I should not hesitate to recommend and perform it as soon as the diagnosis of thrombosis of the cavernous sinus was made.

There are two further matters of interest to be included in this report; namely, the blood counts and the cultures which were made in connection with some of the cases — unfortunately with far too few of them — and these are given below.

Appendicitis (general peritonitis). Diplococcus lanceolatus and bac. coli communis.

" (no culture made). Blood count, leucocytes, .9,500.

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Appendicitis (general peritonitis). Bac. coli communis.
" (no culture). Blood count, leucocytes, 11,200.
" (general peritonitis). Bac. coli communis.
" (inflammation localized). Bac. coli communis.
" (inflammation localized). Staphylococcus pyogenes aureus.
" (general peritonitis). Bacillus coli communis.
" (gangrenous, localized). Streptococcus pyogenes bac. coli communis.
" (general peritonitis). Bac. coli communis.
" " " " " "

Salpingitis (general peritonitis). Streptococcus pyogenes, staphylococcus pyogenes aureus and albus.
" (general peritonitis). Staphylococcus albus.
" " " No organism found.

Abcess of liver (general peritonitis). No organism found.

General peritonitis in connection with perforating gastric ulcer). Two cases.) No pathogenic organisms found in cultures from the peritoneal fluids. Blood count in one case prior to operation. Leucocytes, 7,500.

Tubercular peritonitis. Blood count, leucocytes, 12,400.

Inflammation of gall bladder. Blood count, leucocytes, 16,400.

Septic hand. Pure culture. Streptococcus.
" " " " "

Septic arm. Streptococcus pyogenes.
" " Staphylococcus albus.

Septic leg. Streptococcus pyogenes, staphylococcus pyogenes aureus and albus.
" " Streptococcus pyogenes aureus and albus.
" " " "
" " " "

Septis wound of face. Staphylococcus albus.

(Cultures from swabs of pus in all cases, all being acute suppurative inflammations.)

Acute suppurative cervical adenitis. Streptococcus pyogenes.
" " " " " "

Bubo (suppurating, acute). No organisms. Leucocytes, 8,500.
" " " Staphylococcus pyogenes aureus.
" " " " " "
" " " No organisms.
" " " Staphylococcus albus.

Ischio rectal abscess. Streptococcus pyogenes and great variety of other organisms.
" " " Streptococcus pyogenes and great variety of other organisms.
" " " No pathogenic organisms.

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VII.

CASES OF ACUTE ORAL INFLAMMATION.

By John C. Munro, M.D.

A search of the records of cases of stomatitis, glossitis and Ludwig's angina, severe enough to be treated in the surgical wards, has been made in the attempt to secure a clinical picture of these distressing and serious diseases. No account has been made of the lighter forms treated in the out-patient departments. Too few cases have appeared in recent years to give data as to the bacteriology of these affections. In those examined the streptococci and staphylococci were the predominating agents.

Ulcerative stomatitis. Of twenty-nine cases, six were of the gangrenous type, but the distinction between the ulcerative and the gangrenous case is often difficult, the former so easily advances to the latter, and some undoubtedly of the ulcerative cases were rapidly becoming gangrenous until checked by good care and treatment. The lighter cases exhibited more or less superficial ulcerations of the gums, cheeks, tongue or pharynx, singly or collectively, and probably diphtheria was the true condition in some of the earlier cases. In many there appeared to be no recognizable cause, while others started presumably from carious teeth, a glossitis, or from burns of liquids. One case of recovery showed ulceration of the entire oral cavity; another had a deep, foul, indurated slough of the cheek that was prevented from perforating by treatment with poultices, washes, etc.; still another had severe swelling of the palate, that required incision, but without showing the presence of pus.

In the recovery cases, main reliance was placed upon

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washes containing myrrh, chlorate of potash, permanganate of potash or hydrogen peroxide, in addition to vigorous supporting and stimulating diet.

One child, four years old, where the noma perforated the cheek, recovered under this treatment. The process never advanced rapidly enough to warrant surgical interference.

One fatal case is interesting in that the process originated in a tubercular glossitis that could not be recognized until after death. Swelling of the tongue, cheek and neck started two weeks before entrance to the hospital; soon the tongue ulcerated and gave rise to occasional hemorrhages, and at entrance the mouth was filled with the swollen tongue, sloughs and blood clots. The local condition improved under treatment, but the general condition grew steadily worse. Autopsy showed tuberculosis of the tongue and epididymis, and a severe stomatitis much like that seen in mercurial poisoning. One male, thirty years old, with a gangrenous ulcer of the inside of the cheek, but not perforating, died a few days after entrance, apparently from general sepsis.

Four cases designated as noma died, two being young children and two, men fifty years old. Pneumonia and measles preceded the noma in each child, respectively. There was the typical gangrenous ulcer of the buccal surface advancing to perforation, autopsy showing also a necrosis of the upper jaw and an acute bronco-pneumonia in the one that lived two weeks; sepsis and a pneumonia probably killed the other child at the end of four weeks, before the cheek had become perforated. One of the adults entered in collapse with a gangrene of the cheek extending from the mouth to the ear. In the other case the disease started as an alveolar abscess, followed by a series of abcesses, retraction of the gums and loosening of the teeth. Sloughing of the cheek and necrosis of the lower jaw followed with death at the end of a week.

Acute Glossitis. These cases are interesting from the lack of ascribable cause in many instances, from the rapid onset of swelling, and the equally rapid subsidence under treatment. Of twenty-eight cases, all but five were in males, of about thirty years of age. A sore throat, a blister, a rough

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tooth, or a bite was given as the exciting cause in some, but more frequently no cause could be found. In several the swelling attained its maximum within a day or even within an hour, but in the majority it took four or five days. In half the cases the swelling affected the entire tongue, while in the remainder it was confined to one side or the base. The swelling was great enough in most instances to almost completely fill the oral cavity. Pus was rarely noted, and where the organ was incised relief followed, as well from evacuation of blood as from pus. In eleven cases in which the tongue was opened, either spontaneously or with the knife, there was alarming dyspnœa, while the cases treated with washes and poultices to the neck were for the most part not urgent, and rapidly yielded to the milder form of treatment, a patient rarely being detained in the hospital longer than five days. Two patients died, one from uremia and cystic kidneys, and the other propably from acute sepsis. The latter, a woman of thirty entered delirious, in high fever, and with a phlegmon of the tongue and floor of the mouth. Operation was done at once on account of dyspnœa, but the patient died in a few hours. One markedly alcoholic patient had three attacks at intervals of a month, with two operations.

The history of the cases throughout impresses one with the fact that the phlegmonous type is much severer than the abscess type. In some it is difficult to distinguish between a true glossitis and a Ludwig's angina, and, indeed, the two conditions may coexist, or the disease may start as a cellulitis of the floor of the mouth and extend to the tongue.

Ludwig's Angina. Only nine cases were indexed, one being fatal. Eight were in adult males, and one in a girl of fourteen. One case opened spontaneously into the mouth; all of the remainder were operated upon, some within the mouth, but the majority beneath the chin. The origin of these cases is obscure, carious teeth being the favorite cause ascribed by the patients. The clinical picture is very characteristic in all; a brawny fulness beneath the chin, an elevation of the floor of the mouth to the level of the edge of the teeth, with a pushing upwards and backwards of the tongue, and in some a cellu-

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litis extending in various directions as far as the shoulder or the chest. The single fatal case obtained temporary relief from dyspnœa by free incision into the sublingual space, but within a few hours a tracheotomy was necessitated; dyspnœa, however, returned, and the patient died two days later, probably from a septic pneumonia.

The impression that one obtains from studying these records is that the diseases are severe, and that the treatment required must be vigorous. Where, as in glossitis and angina, the cases are not severe enough to demand immediate operation for the evacuation of pus or (of equal importance) of blood for relief of obstruction to respiration, the medical procedures must in their way be equally energetic. Catharsis, abundant food, rest, cleansing and antiseptic washes, and large, hot poultices to the neck and face will often abort a case that threatens to become serious within a few hours. When, however, there is doubt, or when delay seems dangerous, a free incision into the swollen tongue or the mouth floor is best, whether pus is present or not. The cases of stomatitis can probably be benefited if the gangrenous sloughs are removed with the curette or the cautery.

The incision in glossitis, unless there is a well defined collection of pus — which is not to be expected — is best made into the dorsum on each side of the median line. In the angina cases the incision is best made, in most instances, in the median line below the chin, whence each lateral space can be easily explored with the finger or a blunt instrument until the small focus of pus, if present, is found.

The distress and suffering of these cases is frequently intense; the drooling, the inability to swallow or talk, often the dyspnœa and cyanosis, in addition to the acute general infection, make the condition a grave one, but fortunately, under good treatment, of brief duration and without sequelæ for the most part.

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VIII.

THE RESULTS OF OPERATIONS ON VARICOSE VEINS.

By J. B. Blake, M.D.

The treatment of varicose veins has always been unsatisfactory. Non-operative treatment is palliative, but in recent years a cure has been attempted by operation. This consists either in (*a*) ligation of the veins in several places, with or without the removal of small sections; or (*b*) excision of a considerable portion of the vessel in continuity. Accurate statistics are necessary to determine the success of operative treatment. Cases must be traced and reported after the patients have returned to their customary occupations and habits of life; after the conditions which produced or favored the original varices have again been established.

Statistics of this character are not numerous, and are not easily obtained. Hospital cases are proverbially difficult to trace, and this class of patients is no exception to the rule. Furthermore, it is essential before attempting to classify results, to determine what constitutes a "cure" or a completely successful operation. A simple standard, and one which seems reasonable, is, that if the patient can follow his customary occupation, and considers himself well, the surgeon may consider him cured. And the reverse of this (if the patient's statements can be believed) should equally be held true.

Finally, the element of time and the age of the patient present additional complications, and render a positive standard still more difficult to obtain. An interval of six months after operation is the minimum time limit, and it is probable that this should be extended to a year.

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Statistics conforming to the above requirements have been obtained in eleven cases, all but two of which were operated at the Boston City Hospital. Of these, seven were cured, three were relieved temporarily or partially, and one was worse than before. Some of these patients were examined personally, others replied in writing, and, in one or two cases, members of the immediate family furnished the information.

It is obvious that no sweeping deductions can be drawn from so small a number of cases, but an examination of them shows certain instructive and interesting facts. Briefly stated, these are as follows:

The single case in which the condition was described as "worse than before operation" seems to represent a type in which operation of excision will probably be followed by little or no improvement. It is therefore described in some detail.

The man was sixty-three years of age, born in Ireland, and was a street laborer. He had extensive varicose veins for forty years, and had been operated upon four times, once on the right, and three times on the left leg.

Seventeen years ago the veins in the right leg were ligated subcutaneously with silver wire, at points five inches above, and five inches below the knee. He has had complete relief from painful or distressing symptoms since then. The veins are still visible, and are large and tortuous, from ankle to saphenous opening, and over the entire inside of the thigh, but the man stated definitely that they do not cause him any trouble.

The left leg was subjected to a similar operation in London, twenty-five years ago; it was followed by relief of symptoms for about ten years. Pain and distress then began to return, and, in 1893, a second operation was done in Boston. This consisted of a dissection, and the removal of about ten inches of the left internal saphenous vein. After leaving the hospital he was free from pain for six months, and then the symptoms recurred. In 1895 a third operation was performed, also in Boston. The man said that, owing to his previous experience he desired this last operation should be by "tying, and not cutting." The surgeon, however, made a dissection of about five inches, and the man insists that he has had pain ever since, and worse than before. Examination shows two wide scars, corresponding to the operations described above, but no veins above the knee. Below, the veins are distended, but not as much as on the right side. The leg swells, however, and the pain makes him lame.

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This case is an excellent illustration of the fact that size, or extent of varicose veins, whether in the scrotum, at the anus, or on the extremities, bears no necessary relation to the discomfort or disability of the patient. A large mass of veins may be free from distressing symptoms, and a small varicosity may at times cause a patient to seek hospital treatment.

Three cases are classed as "partially or temporarily cured." In one of these the unpleasant symptoms have entirely disappeared, but an ulcer, which closed after the operation, has broken out again, though its area is smaller than formerly.

A second man has returned to work, though he writes that his "leg still pains him and some of his cords bother him."

The third case was relieved for one year. This patient is a cook and is on her feet all day before a fire. At the end of the year the veins above and below the incision began to swell. Pain commences soon after she begins to work, and increases during the day. She is, however, able to continue her occupation.

Seven cases are considered cured. In one of these the internal saphenous vein had previously been ligated, but without relief. It is to be noted, however, that some of these cases have been operated less than a year, and as it sometimes happens that relapse follows a year of relief, it is obvious that these cases have not yet passed the final stage. These cases represent various degrees of severity, with the exception of extreme varicosity, complicated by advanced age. The ages in this group vary from twenty-five to fifty years, and the occupation included engineers, stablemen, cooks, clerks, etc. In all cases the scars are firm, not tender, and not painful. In four the operation was performed at least three years ago.

In conclusion, it may be said:

1. Operation for radical cure of varicose veins by dissection is not successful in every case.

2. To obtain successful results, cases must be selected, and certain conditions avoided, and recommended to palliative treatment.

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3. The conditions which will probably militate fatally against satisfactory results are:

(*a*) Old age, or an extremely debilitated condition.

(*b*) Excessive and very extensive varicosity.

(*c*) Occupations which to an extraordinary degree favor the development of varicose veins.

4. Cases which may be cured by a thorough and careful operation are:

(*a*) Local varix, even of marked prominence, particularly if thrombosis has occurred, either in thigh or lower leg.

(*b*) Extensive varix, limited to a single venous stem.

(*c*) Varicosities, which are a bar to passing civil service, military or naval examination.

(*d*) Cases in youth and middle life.

(*e*) Cases in which the development of the permanent varicosity was at least partially due to more or less removable conditions (flat foot, garters, etc.).

5. Operation, even if not entirely successful, will usually relieve such complications as thrombosis, hemorrhage and ulceration.

6. The usual conditions which follow unsuccessful operations are:

(*a*) Pain in and around the scar.

(*b*) General swelling and tenderness of the leg.

(*c*) Development of varicosities above or below the operation scar, but not at the site of the operation itself.

7. In all operated cases, general systemic treatment as well as local treatment should be prescribed, together with exercise and the avoidance of a continued upright position whenever possible.

8. Cure of symptoms does not necessarily mean the removal of all visible varicosities.

9. Comparison of relative methods of multiple ligation and continuous dissection must be based upon a larger number of cases than are here recorded.

10. Bennett's conclusions (Lancet, Oct. 15, '98) and his extreme limitation of the indication for successful operation, are too sweeping.

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IX.

THE TEACHING OF SURGERY AT THE BOSTON CITY HOSPITAL.

By Herbert L. Burrell, M.D., and J. Bapst Blake, M.D.

Great public hospitals exist for three purposes; first, to care for the sick; second, to advance scientific research; third, to teach medicine.

Caring for the sick, the first use of the hospital, has always been recognized, not only from the standpoint of the individual, but also for the protection of public health.

The second use, that of advancing scientific research, has been haltingly accepted by the laity, as well as practitioners.

The third use, that of diffusing medical and surgical knowledge to practitioners and students of medicine, has been clearly recognized in the last decade more than ever before.

It is interesting to note the increase in surgical instruction given at the Boston City Hospital during the last ten or fifteen years. In 1887 there was one surgical clinic and one surgical visit a week. On Fridays public operations were done by the surgeons in the ampitheatre. The surgical clinic was given by the Professor of Surgery of Harvard University; large sections of the class attended the visit, and cases were shown by the surgeons. For the fourth-year class, which had recently been started, surgical visits were made on Mondays and Thursdays.

The clinic given by Dr. Cheever was fully attended and greatly appreciated. The clear, brief descriptions of clinical cases, the far-seeing prognoses, and the direct, skilful operating, made the Tuesday clinic one of the favorite exercises of the Harvard Medical School.

The ward visits gradually became less popular. The advent of plaster, and of antiseptic or aseptic dressings, pre-

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sented a ward of hidden fractures and operative wounds. These facts, combined with the necessity of peering over the shoulders of a fellow pupil at a patient lying in a bed beneath a white coverlet, suggested that the method did not constitute satisfactory instruction in surgery. "Walking the wards of the hospital," deemed so important by our predecessors, became less and less valuable, and finally the attendance became irregular and meagre.

The amount of knowledge obtained was small, and it was only with the personality of the instructor that the student was brought in contact. This condition gave rise to sectional teaching in the out-patient department, and small divisions of the class — ten to twenty — attended the out-patient clinics from time to time. These small sections, and the personal contact with the patients have been developed, and at present constitute one of the most valuable forms of instruction. It will never supersede clinical lectures, because it is impracticable for men of mature experience to devote their entire time to small sections of men, and this work must, of necessity, be done by young instructors.

(*a.*) *Operations.* — Many improvements have taken place in operations as viewed from a teaching standpoint. Operations are done in the amphitheatre, and charts are hung up, giving the clinical history of the case that is to be operated, with the differential diagnosis established. The results of operations are shown to the students, and frequently the end result is shown them in the amphitheatre. Not infrequently the more advanced students examine the case to be operated, and make their own diagnosis and prognosis, and give advice in regard to treatment

(*b.*) *Clinics.* — Perhaps no more important advance has been made in the management of surgical clinics than in the grouping of clinical cases. As the hospital has increased in size, and the wealth of material has been recognized, a careful system of recording interesting cases of a common disease or injury has enabled the teacher to give a lecture on fractures of the leg, for example, showing first a recent fracture of both bones of the leg, of the fibula, a Pott's fracture, a compound fracture; then a series of cases illustrating fracture

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of the leg at the end of ten days, at the end of three weeks, six months, and finally one and one-half or two years. In this way a picture of the progress of the disease or injury, which is of great value, is presented to the student's mind.

Experience has taught that the extraordinary and unique cases which are, of course, to the student's mind extremely interesting, are not as desirable clinical material as the common diseases and injuries. The former, as they present themselves in a great hospital, should be shown to students, but never at the expense of omitting the latter.

The sequence of presentation of material has been carefully studied, and attention has been paid to bringing to the student's mind the natural order of injury and disease. This naturally is only possible where a great amount of clinical material exists.

On one occasion, in the course of a year, twenty-eight cases of tracheotomy and intubation were shown to the students, and another time thirty-two cases of appendicitis, which were recent, had been operated upon, or had not been operated upon, were shown to the students, and some of the cases were examined by them.

On another occasion fifteen fractures of the skull of various types and conditions, from a simple linear fracture to a compound depressed fracture were shown to the students. All such things are possible with a large amount of clinical material carefully watched, analyzed, and tabulated.

Pathological Material. — The impetus that has been given to medicine and surgery at the hospital by the establishment of the pathological laboratory cannot be exaggerated. In the surgical clinics the students are constantly taught to explain clinical phenomena by pathological conditions, and fresh pathological material is shown whenever possible.

The results of the examination of morbid specimens and of cultures are reported, and the student attending the clinics consecutively is kept informed of the progress of the cases. When occasion arises the student goes to the autopsy.

Another important step has been made in the use of clinical material to illustrate corelative didactic lectures. For example, a lecture is given at the Medical School on

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appendicitis, on Monday; on Tuesday the students are shown five to fifteen cases, illustrating the various stages of the disease; on Wednesday another didactic lecture is given, finishing the subject of appendicits; on Thursday again clinical material is shown, and operations on appendicits are done. The following week a recitation on the subject is held. This concentration of teaching on a given subject is found to be of great value.

The consultation of students and surgeons is of inestimable value, and, while it is not often done in the amphitheatre, yet it is frequently brought about in small sections. In the amphitheatre two students are selected. One gets the clinical history of the case, the other makes the physical examination. They are told that if they wish consultants, they may call them from their fellow-students. The examination of the patient, and the consultation are conducted as they would be in private practice. To illustrate the efficiency of the students in this work the fourth-year class, on one occasion, in the season of 1899–1900, established the diagnosis of filaria sanguinis hominis, and identified the organism under the microscope in the amphitheatre.

Another method of teaching is to have a formal consultation of a group of surgeons in the presence of the students, each surgeon expressing his views in order of seniority, the case being summed up at the end by the instructor. In both of these instances, if operation is indicated, it is done immediately afterward in the presence of the students, and those pupils who have actively taken part in the consultation, assist at the operation.

The teaching of surgery to small sections of students in the out-patient department has been carried on for a number of years, but from a variety of causes the attendance has been very irregular. The conflicting exercises at the school attract the student here and there, and it has been impossible to know how many students would come to the exercises in a given subject. This has been disheartening to the instructors and demoralizing to the whole course, and finally the students have obtained their knowledge in minor surgical work by acting as dressers in the various hospitals and

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dispensaries of Boston. Sectional work conducted in a "come if you will" manner is not successful.

Occasionally, a section of men would attend faithfully, and the instructor, encouraged by their presence, would carefully prepare for their work each morning. But the best students, as a rule, did not come, preferring to obtain their knowledge of minor surgery by an appointment as dresser at one of the hospitals.

One of the most valuable forms of teaching is one which was carried out very fully by Dr. Lovett in the wards of the hospital. "The students were gathered about the bed in small numbers — not over twelve — and one of the number was chosen to make a thorough examination, subject to the instructor's correction, to give the diagnosis, the differential diagnosis, the indications for treatment, the nature of the treatment and the principles of prognosis. When a student was unable to answer a question or take the next step his fellows were invited to help him."

The fourth-year students have, during the last eight years, been brought more and more in contact with the patient in the ward, and towards the end of their instruction the subject of surgery has been presented to them in small sections from different points of view. For example, sections have been taught surgical therapeutics, office visits, clinical surgical pathology, medico-legal examinations in surgical cases, and a course in sterilization of materials has been given them.

It will never be possible, nor is it desirable, to have students turned loose in a ward in contact with patients. They must always be under supervision, and they gain a great deal of information and grow in their capacity to do surgical work by being in actual contact with patients.

It is often considered that if a student is thrown on his own resources he will make more advance than if his efforts are guided. In the abstract this is true, but in its application to surgery it is not true. It is neither desirable nor possible to allow students to examine surgical cases except under the closest supervision.

There are few students in each class who could be allowed

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the opportunity of operating under guidance, but they can gain the technique and a familiarity with the details by operating upon animals. A careful study of the conditions governing the education of students and the rights of the individual patient convinces me that it is neither desirable nor possible for students to do operations on human beings. That they can be used as assistants is both desirable and possible, but they must be under a stricter form of discipline than they are at present. By that is meant that they must have required instruction in the foundation principles of surgery, and it must be known that these principles have been acquired before they are allowed to take part as assistants in an operation.

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X.

A CONSIDERATION OF TWENTY-EIGHT CASES OF TUBERCULOUS PERITONITIS AT THE BOSTON CITY HOSPITAL, WITH PARTICULAR REFERENCE TO THE RESULTS OF OPERATIVE TREATMENT.

By John T. Bottomley, M.D.

The effect of laparotomy on tuberculous peritonitis has received much attention for the past fifteen years. Reported results vary greatly, not so much with respect to the advisability and benefit of operative treatment as to the proportion of recoveries resulting therefrom. In many reported cases the diagnosis was a clinical one only; in others, reports of recoveries were made too soon after operation; thus results obtained were often subject to criticism. Consequently, in the following series an attempt has been made to exclude all cases in which the clinical diagnosis was not confirmed either by the microscope, the tuberculin test, or by autopsy and to report as recoveries only such cases as were seen or heard from not earlier than one year after operation. One exception to each of these conditions, and the reason therefor will appear in the course of the article.

Case I. — Female, twenty-three, entered hospital, April 27, 1895. *F. H.* Negative. *P. H.* "Inflammation of bowels," two years ago. Ill two to three weeks. *P. I.* For four months numerous attacks of neuralgic pain, starting in right iliac region and running into right shoulder. Between attacks was well for a week or two. Attacks were of several days' duration; for past six weeks pains in right iliac region have been constant; some vomiting; patient not confined to bed. Heart and lungs not examined. Abdomen sensitive in right iliac region; vaginal examination negative; no tumor nor

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induration found. Temperature before operation, irregular (99°–102°). Operation, April 30 (Dr. Gay). Incision over tender area. A pint of clear, serous fluid escaped from the peritoneal cavity. Nodules on intestine and omentum, varying in size from a pea to a ten-cent piece. One of the nodules excised: drainage used. Pathological report, "tuberculous."

Patient died very soon after leaving the hospital. From the symptoms learned on inquiry the cause of death was probably general tuberculosis.

Case II. — Female, nineteen, entered hospital, May 1, 1895. *F. H.* and *P. H.* Negative. *P. I.* Six weeks before had sudden severe pain in epigastrium and some vomiting; considerable distention, which was relieved after one month, and then some induration could be felt in left iliac region. The induration has increased in extent; no pain; some local tenderness. Heart and lungs negative. Decided sense of resistance in left lower abdomen; tenderness there; no distinct mass. Temperature slightly elevated. Operation, May 3 (Dr. Gay). Peritoneum much thickened. Intestine very adherent to it, and was opened; immediate suture. Rather small tubercles all over parietal and visceral peritoneum. Adhesions very firm. Drained. Pathological report, "tuberculous."

June 12. Discharged without symptoms; condition good; temperature about normal.

Seen five and one half years after operation. Has had no trouble since operation. Marked increase in weight. Feels better than she ever felt before. Works hard; temperature, normal. Has a small ventral hernia. Physical examination otherwise negative.

Case III. — Female, twenty-four, entered May 29, 1895. *P. H.* Negative. *F. H.* "Typhoid," four years ago. Indefinite sickness referred to epigastrium, two years ago. Not well last summer; epigastric pain then. *P. I.* Three months ago began to have much pain in lower abdomen. In bed since. Has nausea with the pain. Pain growing less. No catamenia for past three months. Heart negative; harsh respiratory murmur and moist râles at right apex. Abdomen slightly distended and tympanitic, not especially tender; no mass palpable. Temperature slightly elevated. Operation, June 3 (Dr. Gay). Intestines and omentum very adherent. Tubercles on both; attempt made to break up adhesions, which were very firm; drainage used. June 11, fecal fistula. Temperature elevated (99° — 101°); gradually failed; marked emaciation; died July 24. No autopsy. Clinically a case of tuberculous peritonitis. No pathological report. Case included in list because of signs in lungs.

Case IV. — Male, twenty-four, entered hospital, August 20, 1895. *F. H.* and *P. H.* Negative. *P. I.* "Running down" for three months. Gave up work one month ago. Weakness and pain in epigastrium; some diarrhœa; some cough for last two weeks; distention

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noted one month ago; temperature, 99°–101°. Heart negative. Fine râles and bronchial breathing at both apices. Abdomen full, tense, but not tender; dulness in flanks. Indefinite resistance in places in abdomen suggesting small masses. Operation, October 14 (Dr. Watson). Peritoneum and gut very adherent; no fluid; few tubercles. Adhesions were very dense and intestine was wounded during operation; immediate suture. Drained. Pathological report, "tuberculous." Slight improvement after operation. Abdomen still distended. Emaciation marked and progressive. October 10, fecal fistula; high, irregular temperature (99°–103°). October 25, death. No autopsy.

Case V. — Male, eleven, entered hospital, April 25, 1896. *F. H.* and *P. H.* Negative. *P. I.* Ill six weeks with symptoms of malaise; pain all over, especially in head and abdomen; few chills; some nausea; distention began two weeks previously. Patient is much emaciated. Heart and lungs negative; abdomen prominent; rather tense; tympanitic area in centre. Signs of free fluid; movable tumor on right above umbilicus; slight tenderness there. Temperature, 99°–100.5°. May 2, tapped; five pints of clear fluid withdrawn. Fluid collected again in a very days. Operation, May 23 (Dr. Post). Bowels matted together. Some loops adherent to parietal peritoneum; adhesions separated; large cavity containing clear fluid opened; some tubercles on wall of cavity; portion of wall excised. Drained. Pathological report, "tuberculous." June 17, improved; sinus open; abdomen still distended. July 17, discharged. Wound closed; excellent general condition.

Seen four and one-half years after operation. Feels perfectly well; has been working for some time; abdominal examination negative. Has chronic ear trouble.

Case VI.—Female, fourteen, entered January 6, 1897. *F. H.* Negative. *P. H.* Negative. *P. I.* Ruddy, fat and strong three months ago. Then began to have dull frontal headache daily; two months ago began to lose weight and strength; one week ago, sharp, darting pains in abdomen noticed; pain not well localized. Three weeks previous to that some abdominal distention appeared. It has increased; no tenderness; no vomiting; bowels regular. Patient is emaciated; heart negative; signs of some fluid in right chest. Abdomen distended, tympanitic in centre; signs of free fluid. January 11. Reacted markedly to the tuberculin test; abdomen tapped and much straw colored fluid escaped. Fluid began to collect again. Operation, January 18 (Dr. Burrell). Peritoneum thickened, rough and granular, especially in pelvis. Some of the granular tissue removed; much free fluid present. Drained. Pathological report: "Tuberculous." February 8. Belly still swollen; general condition better. February 15. Belly still swollen; more or less abdominal pain. February 20. Discharged, improved; still some pain; abdomen

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almost flat. May 7, re-entered; has gained in strength, but is not well. Abdomen distended and tense. Came to hospital because wound is not healing well. Discharged in a short time. Temperature, subnormal during stay in hospital. December 13, 1899. Re-entered for operation on ventral hernia; in three weeks discharged, perfectly well.

Seen three and three-fourths years after operation for tuberculous peritonitis. Is a picture of health; has occasional "weak spells." Physical examination, negative; abdomen, perfectly flat.

Case VII.—Male, forty, entered January 27, 1897. *F. H.* and *P. H.* Negative. *P. I.* Began to fail in health one and one-half years ago; became constipated and began to grow weak. For the past year, pain and discomfort in abdomen, especially after eating; four months ago abdominal distention first noticed. Tapped seventeen days ago; "three gallons of water drawn." In five days presence of fluid again detected; some pain in epigastrium. Heart and lungs negative; abdomen moderately distended; much fluid; fluctuation wave. January 30. Marked reaction to tuberculin test. Operation, February 3 (Dr. Bolles). Much clear fluid; tubercles of parietal and visceral peritoneum; some tubercles as large as the end of a finger; few adhesions; wound closed. February 20. Discharged in better general condition; abdomen still distended. Temperature, 102°–103°.

Seen three and two-thirds years after operation; is perfectly well and now working; temperature, normal; physical examination, negative. Is as well as he ever was in his life. The winter after his operation he had considerable abdominal pain which bothered him more or less till the next spring. Has had no return of it since then. Weighs as much as he ever did, 165 pounds.

Case VIII. — Male, four and one-half, entered February 11, 1897. *P. H.* Said by doctor to have had phthisis for some time. *P. I.* Child not well for past two weeks; malaise; pain in abdomen; three days ago abdomen began to swell; pain increased; patient constipated. Patient much emaciated; abdomen extremely distended; fluctuation wave. Operation, Februray 11 (Dr. Burrell). Gush of clear, straw colored fluid; numerous adhesions broken up and more fluid escaped. Some tubercles. Drained. Pathological examination "tuberculous." March 14. Still some discharge from wound; abdomen still somewhat distended. Did not improve for six weeks after operation; then marked improvement began. April 10. In good general condition; no symptons; abdomen still distended; wound healed. Temperature irregular (99°–101.5°).

Parents say he continued to do well for about six weeks after he left the hospital. Taken with convulsions one morning and became weak; convulsions continued; child gradually failed, and died three months after leaving hospital. Cause of death unknown.

Case IX. — Male, twenty-three, entered hospital March 11, 1897.

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F. H. Negative. *P. H.* "Typhoid," three years ago; "pleurisy," two years ago. *P. I.* About two years ago "cramps" in abdomen near umbilicus; lasted but a few hours. Well afterwards until about two weeks ago; then pain returned; it was more severe and continues; pain all over abdomen now; nauseated most of the time; some vomiting; constipated; heart negative; suspicious signs at right apex. Abdomen distended; tenderness and rigidity on right in iliac fossa. Indurated nodule to the inner side and above anterior superior spine. Operation, March 26 (Dr. Burrell). Peritoneum studded with tubercles; omentum adherent everywhere; adhesions broken up and much clear fluid liberated; many nodules in omentum. Drained. Pathological examination, "tuberculous." April 21. Discharged, in fair general condition; still some abdominal pain. Temperature, 99°–101°. This patient could not be traced.

Case X. — Female, ten and one-half, entered, April 12, 1897. *F. H.* Grandfather had tuberculous peritonitis. *P. H.* Negative. *P. I.* For two years pain in abdomen; worse for past three or four months and patient had to give up school; losing weight; no cough; no diarrhœa; abdominal distention first noticed two months ago. Heart and lungs not examined; abdominal walls tense; no marked tenderness; distended; signs of much free fluid. Temp., 99°–100°. After being in the hospital two weeks developed diphtheria. Sent to Contagious Department. Re-entered, May 15; distention has increased; general condition good. Operation, June 3 (Dr. Post). (Tuberculin test had been tried twice but gave no reaction.) Peritoneum and bowels studded with tubercles; many adhesions between loops; these were broken up; much free fluid; some tubercles removed. Drained. Pathological report, "tuberculous" June 22. Discharged in excellent general and local condition.

Seen three and one-third years after operation. For some months after operation had abdominal pain; none now for a long time; looks and feels perfectly well; temperature, normal; physical examination, negative; has gained much weight.

Case XI. — Male, twenty-two, entered, April 12, 1897. *F. H.* and *P. H.* Not obtained. *P. I.* Ill seven days; working up to that time; has severe pain low down in abdomen; slight diarrhœa; no vomiting; heart negative; lungs show suspicious signs in right back low down; abdomen full, tense and tympanitic in centre; dull in flanks; fluctuation wave; tenderness over lower abdomen; irregular temperature rising to 100° and 101° in P.M. April 25. Distention has increased; no pain nor tenderness now; tapped and eight and one-half pints of amber colored fluid drawn; then irregular mass could be felt above and to left of umbilicus. May 10, tuberculin test; no reaction. Fluid reaccumulated soon. Operation, May 10 (Dr. Gavin). Peritoneum much thickened; numerous fresh adhesions broken up and two or three pints of greenish yellow fluid escaped. Many small

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tubercles on peritoneum; abdominal wall thickened and a growth apparently involved it, the peritoneum and the omentum; piece of growth removed; wound closed. Pathological report "tuberculous." June 2. Abdomen refilled; wound opened spontaneously; fluid escaping. September 8. Discharge persistent; general condition fair; abdomen still distended; irregular masses can be felt all over abdomen. September 14. Discharged to State Hospital; sinus open; general condition good; abdomen still distended; running a "pus" temperature. Discharged from State Hospital ten months later; general condition very good; sinus still open. Patient could not be traced further.

Case XII. — Female, seven, entered, August 4, 1897. *F. H.* Negative. *P. H.* Operation at Children's Hospital for "ovarian cyst" some months ago. (A record of this could not be found at the Children's Hospital.) *P. I.* Soon after this operation patient began to show signs of hip disease on the left side; later had some pain in abdomen and in left lumbar region; loss of flesh. Patient now shows a discharging sinus from former operation; heart negative; lungs show râles, etc., at left apex. September 18. Abdomen rather prominent; some general abdominal tenderness, more marked in left flank where there is dulness; sinus still discharging; abdominal pain. Operation, October 7 (Dr. Monks). Sinus leads into abdominal cavity where there is a large abscess; some material from wall of abscess excised; drained. Pathological report, "tuberculous." Discharged, January 29; general condition excellent; sinus still open. This case could not be traced.

Case XIII. — Female, twenty, entered November 13, 1897. *F. H.* Negative. *P. H.* "Inflammation of bowels," three years ago. *P. I.* Twenty-four days ago, while menstruating, taken with sudden attack of severe pain in lower abdomen, chiefly on the right; tenderness there; no vomiting; constipated; heart and lungs not examined; abdomen not distended; tenderness over both ovarian regions; considerable muscular rigidity over lower abdomen; in right lower quadrant is an ill-defined mass; bulging, fluctuating mass felt by vagina. Operation, November 19 (Dr. Monks). Peritoneum studded with small, whitish tubercles; both tubes and ovaries inflamed and bound down by adhesions; considerable free sero-purulent fluid; uterine adnexa removed. Drained. Pathological report, "tuberculous." December 17. Some abdominal pain; sinus still open; irregular temperature. February 3. Discharged in excellent condition; sinus closed. This case could not be traced.

Case XIV. — Male, twenty-eight, entered, December 8, 1897. *F. H.* Negative. *P. H.* Laid up for two weeks, one year ago, with an attack similar to the present. *P. I.* Ten days ago, when feeling perfectly well, taken suddenly with sharp shooting pain in right lumbar region; nausea and vomiting followed; slight diarrhœa; pain contin-

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ues; heart and lungs negative; abdomen slightly distended; some tenderness in region of gall bladder; dulness over lower abdomen and in flanks; signs of free fluid; no masses palpable; temperature runs from 99° and 100° to 102° and 103°. December 15. Tapped and eighty-four ounces of amber colored fluid drawn; then a smooth, indefinite, rounded body, easily movable, could be felt in right lower quadrant; fluid reaccumulated. Operation, December 24 (Dr. Bolles). Peritoneum and omentum adherent and thickened; small, shot-like tubercles everywhere; two masses of omentum, one in right iliac fossa and one up under liver; these were broken up and considerable fluid escaped; bit of tissue excised; wound closed. Pathological report, "tuberculous." January 2. Fluid reaccumulating; no subjective symptoms; temperature, 99° to 101°. January 8. Discharged; general condition excellent; fluid still present.

This patient was not seen, but a report was received from him two and five-six years after operation. He says he is perfectly well, and is working at his trade (baker). Abdomen is not distended.

Case XV. — Male, twelve, entered, April 10, 1898. *F. H.* Negative. *P. H.* Four months ago sudden attack of severe abdominal pain, pretty well localized in right iliac region; no vomiting; slight abdominal distention; attack lasted three days; then all symptoms disappeared. Well afterwards till nine weeks ago, when he began to lose flesh and strength and to be "sick all over." Five weeks ago another attack of severe abdominal pain; since then more or less abdominal pain and tenderness, especially on right side; night sweats; some nausea; degree of distention has varied. Heart negative. Lungs show signs of tuberculous trouble on left side. Abdomen considerably distended; some general tenderness, most marked on right, where there is an indefinite tumor; numerous small masses can be felt in abdomen. Operation, April 15 (Dr. Gavin). Much clear fluid; nodules in omentum; one excised. Numerous tubercles of omentum and peritoneum. Drained. Pathological report, "tuberculous." April 29. Abdomen distended; still some pain. May 13. Discharged; general condition good; abdomen still distended. Gradually failed after going home and died three weeks after leaving the hospital. Cause of death unknown.

Case XVI. — Female, twenty-eight, entered, August 18, 1898. *F. H.* and *P. H.* Negative. *P. I.* Three weeks ago pain in abdomen above umbilicus; constipated; some cough; abdominal distention began two weeks ago and is gradually increasing. Diarrhœa since then. Heart and lungs negative; abdomen much distended; signs of free fluid. Operation, August 19 (Dr. Gavin). Six to eight quarts of yellow, turbid fluid escaped. Peritoneum over intestines, tubes, ovaries and appendix thickly studded with tubercles. Parietal peritoneum comparatively smooth. Appendix removed; wound closed; appendix found by pathologist to be "tuberculous." Diarrhœa

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followed the operation; some distention and considerable pain remained. September 10. Wound opened spontaneously; fecal fistula. Patient gradually failed and died September 23. Temperature irregular, (101°–104°.) No autopsy.

Case XVII. — Female (colored), twenty-two, entered, October 26, 1898. *F. H.* Negative. *P. H.* Some pain in left side of abdomen for four years. *P. I.* Four weeks ago noticed some abdominal swelling about navel and began to be tender in that region; felt weak; swelling "broke" six days ago; foul discharge since; no pain. Heart and lungs negative. Abdomen somewhat distended. Some thickening about umbilicus and a sinus discharging foul material leads into this. November 1. Consolidated spot in left lung discovered. Operation, November 2 (Dr. Lovett). Large abscess between parietal peritoneum and omentum, extending down to left of bladder. Much foul pus escaped. Drained. Continued to fail; ran "pus" temperature and died, December 7. Autopsy showed tuberculosis of lungs, liver, spleen, pleura, bladder, intestines, and peritoneum. Several fistulæ opened from abscess cavity into ileum.

Case XVIII. — Male, twenty-two, entered, November 5, 1898. *F. H.* and *P. H.* Negative. *P. I.* Epigastric pain of eleven days' duration. Heart negative; consolidated area at apex of left lung; abdomen tense, distended. Signs of free fluid. October 22. Tapped; eleven pints of clear, straw colored fluid; fluid soon reaccumulated. Operation, November 7 (Dr. Monks). Much free straw colored fluid, slightly turbid. Peritoneum granular and studded with tubercles; appendix studded, too. Removed. Wound closed. Pathological examination of appendix showed it to be "tuberculous." December 3. Discharged in excellent condition in every way. Temperature shows P.M. rise to 100°. This case could not be traced.

Case XIX. — Male, five, entered, December 30, 1898. Has a congenital inguinal hernia. Abdomen prominent; no evidence of fluid. When hernia is reduced a certain amount of thickening can be felt from testicle upward along the cord. Operation, January 26, 1899 (Dr. Bolles). Radical cure of hernia. Sac ligated and removed. Inside of sac found covered with yellowish granules. Pathological report, "tuberculous." Temperature ran about 99°. Discharged, January 26. Re-entered, March 22; much loss of flesh since operation; abdomen has gradually distended; signs of free fluid. Temperature, 100°; no recurrence of hernia. Operation, March 24 (Dr. Bolles). Much clear fluid; peritoneum studded with tubercles; wound closed. April 18. Discharged in excellent general condition; abdomen still distended. Temperature, 99°–100°.

Mother of child was seen one and a half years after operation. Says child has been perfectly well. Never had any trouble of any kind since operation. Goes to school. No abdominal distention. Eats and sleeps well. Is fat.

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Case XX. — Female (colored), nineteen, entered, January 3, 1899. *F. H.* Negative. *P. H.* Typhoid at seven years of age. *P. I.* Cold with cough and some expectoration for past three or four weeks. Has not felt well. Considerable pain in abdomen on left side. No other symptoms. Had to give up working. Temperature, 102°. Heart negative. Suspicious signs in left lung. Abdomen distended but not tender. Signs of free fluid. Operation, January 26 (Dr. Watson). Eight quarts of greenish fluid escaped from a walled-off cavity. Numerous adhesions; lining of cavity thick but fragile; a piece of it was excised. Cavity drained. Pathological report, "tuberculous." February 15. Great improvement; even the cough is better. Discharged, March 16; sinus open still; patient comfortable; temperature, low (99°–100°). Re-entered, April 11; one week after leaving hospital discharge increased and became fecal; no pain; no tenderness. Patient gradually failed and died, April 19. No autopsy.

Case XXI. — Female, twelve, entered, February 24, 1889. *F. H.* and *P. H.* Negative. *P. I.* Two weeks ago began to lose appetite and to be feverish at night. Four days later pain in abdomen, and abdomen began to swell; distention and pain have increased; loss of flesh and strength; diarrhœa. Heart and lungs negative; abdomen much distended; signs of free fluid. Operation, February 27 (Dr. Bolles). Much clear fluid. Parietal and visceral peritoneum studded with tubercles. Excision of a bit of tissue. Wound closed. Pathological report "tuberculous." Discharged, April 15; no symptoms, no distention; no signs of fluid.

Seen one and two-third years after operation. Perfectly well; has gained steadily in weight. Temperature, normal. Physical examination, negative. Looks very well; is going to school.

Case XXII. — Male, sixty, entered, June 21, 1899. *F. H.* and *P.H.* Negative. *P. I.* Six weeks ago noticed that abdomen was swelling; bowels loose but not troublesome; no pain. Abdomen uniformly distended; no tenderness; no tumor felt. Operation, June 29 (Dr. Post). Adhesions everywhere; these were broken up and much fluid was set free. Intestine accidentally opened; sutured. Adhesions very firm, indicating an old process. Miliary tubercles of parietal and visceral peritoneum. Drained. Pathological report, "fibrous tissue with hemorrhage." Improved for a short time. July 21, fecal fistula. August 6, failing; much emaciated. Death, August 10. Autopsy. Lungs negative, except for one small area of tubercular consolidation in right apex. *No intestinal lesions.* Parietal peritoneum covered with flattened yellowish nodules, in part discrete, in part confluent. Omentum, liver, spleen and intestinal peritoneum also show these; chronic adhesive pleurisy.

Case XXIII. — Male, twenty-one, entered, July 12, 1899. *F. H.* and *P. H.* Negative. *P. I.* Fve days ago malaise began; some ab-

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dominal pain; "sick all over." Heart and lung negative; abdomen tense, tympanitic, — tender all over. Inguinal hernia on left. Sent to surgical side, July 12. Operation, July 12 (Dr. Post). Hernia found to be omental. Operation for radical cure, July 13, complained of bandage being tight; abdomen distended. This distention increased. Some dulness and resistance in left iliac fossa. No tenderness. Temperature, 102.5°. Operation, July 31 (Dr. Post). Clear fluid in peritoneal cavity. Many thin adhesions easily broken up. Mass on left running down into pelvis and upward as far as one can reach, and is apparently diseased omentum; a portion of this was removed; several small cavities in mass (pus ?). Drained. Pathological report, "tuberculous." August 6. Abdomen still distended; pain and tenderness continue. September 16, discharged; sinus still open. Re-entered, September 24. Fecal fistula; "pus" temperature. September 27, sent to State hospital where he soon died. No autopsy; cause of death unknown.

Case XXIV. — Female, nineteen, entered, August 5, 1899. *F. H.* Negative. *P. H.* "Typhoid" in September, 1898; "inflammation of bowels" in February, 1899. *P. I.* Ten days ago sudden onset of sharp pain in epigastrium, paroxysmal in character; much vomiting. Symptoms continue but are less severe. Temperature, 101.5°. Abdomen universally rigid and tympanitic; slight distention; more resistance on left than right. Tenderness on left side; no tumor palpable. Vaginal examination negative. August 18, constant dull pain to left of and above umbilicus. Under ether a cylindrical tumor can be felt running from umbilicus out to just inside anterior superior spine on left. Operation, August 21 (Dr. Monks). Adherent to anterior abdominal parietes and to descending colon is the cylindrical tumor which is rolled up omentum. This was tied off and removed. A tough fibrous band compressing a loop of intestine was also removed. Lymph nodes of mesentery enlarged and reddish black in color. All over mesentery of large and small intestine are tubercular nodules. Parietal peritoneum thickened, rough and granular; nodules on it also. Drained. Pathological examination, "tuberculous." September 15. Discharged; wound closed; no subjective symptoms. Indurated mass can be felt to right of umbilicus.

Seen one and one-sixth years after operation. Looks very well; has gained a great deal in weight; still has occasional abdominal pain. Temperature, 99.5°. Abdominal examination negative. Says she does not feel very strong. Is working hard. Some soreness over abdomen last winter, but none for a long time now. No abdominal mass palpable.

Case XXV. — Female, twenty-nine, entered August 28, 1899. *F. H.* and *P. H.* Negative. P. I. Eight days ago pain began in right iliac region and abdomen began to swell. Pain and distention have

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increased, and tenderness is well marked on left side. Temperature, 103°. Heart and lungs negative. Abdomen much distended; signs of free fluid; no tumor palpable. Operation, August 29 (Dr. Monks). Parietal and visceral peritoneum thickly studded with tubercles; some tissue excised; much clear fluid; wound closed. Pathological report, "tuberculous." September 9. Fairly comfortable. Fluid has been reaccumulating, and abdomen is now as distended as ever. September 11. Operation (Dr. Monks). Wound opened; adhesions broken up; more clear fluid evacuated. Drained. September 17, abdomen as distended as ever. General tenderness. October 4. Fecal fistula. November 2. Discharged not in good condition. Sinus still open. Re-entered, November 8. Temperature, 99°. Abdomen somewhat rounded and distended; tympanitic; sinus still discharging. Discharged, November 29. General condition, excellent; no abdominal symptoms; feels very well; sinus about healed.

Seen one and one-sixth years after operation. Great increase in weight; feels well and strong. No pain; no distention; small ventral hernia. Is working. Temperature, 99°.

Case XXVI. — Male, thirty-one, entered, December 4, 1899. *F. H.* Negative. *P. H.* "Typhoid," four years ago. *P. I.* Nine weeks ago mild onset of pain in abdomen; constipated; dull, constant pain since, usually low down in abdomen. Much loss of weight. Temperature, 100.4°. Abdomen somewhat distended, fairly tense; tympanitic except to right and below umbilicus, where there is a dull area; tenderness and spasm of lower abdomen. Operation, December 15 (Dr. Burrell). Mass of omentum covered with miliary tubercles in all directions. This is adherent to the similarly affected parietal peritoneum. Underneath is a smooth, fluctuating tumor, size of a cocoanut. Incised. One quart of clear fluid escaped; numerous smaller cysts with jelly-like material. Drained. Pathological report: "Tuberculous." January 8. Steadily improving. January 19. Discharged; abdomen slightly swollen, tympanitic. Good general condition. Temperature slightly elevated. Went to his home in Vermont. Gradually failed and died in two to three months. Cause of death unknown.

Case XXVII. — Female, twenty-four, entered, December 7, 1899. *F. H.* Negative. *P. H.* Operation for extra-uterine pregnancy two years ago. *P. I.* Yesterday morning sharp, sudden pain in right iliac region; pain extended across lower abdomen; vomiting. Temperature, 102.5°. Abdomen not distended; marked tenderness in right iliac region; no dulness; no mass. December 8. Operation (Dr. Bolles). Omentum thickened and adherent in right iliac fossa. Several round, hard masses felt in mesentery, near head of cæcum, where omentum was adherent. Appendix normal. One of the enlarged mesenteric glands removed; wound closed. Pathological

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report: "Calcified nodule surrounded by firm fibrous tissue; tuberculous." December 18. No subjective symptoms. January 1, 1900. Discharged well.

Seen eleven months after operation; much gain in weight and was feeling perfectly well till last week, when she miscarried. Has had no abdominal symptoms since operation. Had good color and felt well. Now rather pale from excessive loss of blood. Abdomen entirely negative.

Case XXVIII. — Female, nineteen, entered, December 29, 1899. *F. H.* Negative. *P. H.* "Typhoid," some years ago. *P. I.* Two weeks ago sharp onset of abdominal pain, mostly in epigastrium; for some days past has had constant pain which has been located in right lower quadrant of abdomen. Constipated. Temperature, 99°. Abdomen not distended; generally tympanitic; no mass palpable. Operation, January 10 (Dr. Burrell). Peritoneum studded with miliary tubercles; no fluid in cavity; appendix studded; removed; wound closed. Pathological examination of appendix, "tuberculous." February 9. Discharged; no abdominal symptoms; no tenderness or distention.

Seen eleven months after operation; no pain; feels weak still, but stronger than before operation. Some tenderness about seat of operation; weight about the same; poor appetite. Temperature, 99°. Lungs negative.

In just what proportion of cases of tuberculosis the peritoneum shows tuberculous lesions we do not, as yet, know. The difficulty of making an absolutely certain clinical diagnosis of the disease, and the fact that in its whole course it may be entirely latent accounts in part for this uncertainty. Nor do the reported results of autopsies tend to make us more secure on this point. Nothnagel, in his recent work, states that he finds among reported observations the remarkable variation of from 1¼ per cent. to 16⅛ per cent. Borschke is the authority for the highest figure. Of 4,250 autopsies performed during six years at the Breslau Pathological Institute tuberculosis was found in 1,393 (32.8 per cent.); in 226, or 16⅛ per cent., of these 1,393 cases the peritoneum was affected. In commenting on this wide variation Nothnagel says that, while he has never found tuberculous peritonitis in so large a proportion of cases as did Borschke, yet he has met with it much more frequently in Vienna than in other places where he has taught. Undoubtedly the frequency varies with the locality. Of 1,170 autopsies at the Boston City Hospital since January 1,

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1895, tuberculosis was present in some form in 197; in 14 of these the peritoneum was affected. In other words, in 16.8 per cent. of the autopsies tuberculosis was found and the peritoneum was affected in 7.1 per cent. of these — less than one-half as frequently as in the Breslau cases, in which, by the way, tuberculosis in general was about twice as frequent as in the Boston City Hospital cases.

Whatever may be the uncertainty with regard to the frequency of tuberculous peritonitis in general, primary, uncomplicated tuberculous peritonitis is certainly very uncommon. In his 226 cases Borschke found it twice; Munsterman met it once in forty-six cases; Osler mentions five cases in seventeen post mortems of which he has notes, and reports one case; it was found in none of the City Hospital autopsies, and writers, as a rule, consider it rare. The disease is usually a secondary process. Sick's statistics of 2,500 autopsies show 25 per cent. of the cases of tubercular peritonitis to be secondary to tubercular disease of the genital tract and 65 per cent. to tuberculosis of the intestinal tract. Pribram (quoted by Wood and Fitz) of 165 cases examined post mortem attributed eighty-seven to intestinal, sixty-five to pulmonary, eight to tubal and uterine and five to osseous tuberculosis. Borschke, on the contrary, in his 226 autopsies failed to find a single case secondary to a primary, isolated tubercular lesion of the intestine; in fact, in eighty-six of his cases the intestine was almost or entirely free (see autopsy, Case XXII. of this series); while in 140 there was a primary tubercular affection of the lungs *associated* with marked tubercular lesion of the intestine. Phillips (quoted by Anders) reports 107 cases, in ninty-nine of which the lungs were involved, in sixty the pleura, and the intestine in 80.

Nothnagel thinks the primary affection is most often in the lung. The genito-urinary tract, the intestines, the bones (particularly the hip-joint), the head, and the bronchial and mesenteric lymph glands may show the primary focus. F. Markel has recently called attention to the frequency of the glands at the bifurcation of the trachea as the initial point.

Operative statistics go to prove that the disease is much more common in women than men, Nothnagel and Lindner

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finding that 90 per cent. of the reported cases were in women. König, in 1890, reported 120 of 131 cases operated as occurring in women. Osler's collected statistics show the disease to be twice as common in women, though of his own twenty-one cases fifteen were men. One hundred and one of Nothnagel's 164 case were in men. Most autopsy records seem to indicate that the disease is more common in men, the proportion being as three is to one. Eighty-nine of König's 107 cases found post mortem occurred in men; of the fourteen cases autopsied at the City Hospital, eight were women and six men. It is probable that the disease is really more common in women; for it seems scarcely credible that the great predominance of women in reported operative cases can be due solely to the fact that laparotomy is performed more often on that sex, and for that reason the disease is found in them more frequently. In this series the sexes are equally represented — fourteen men and fourteen women.

The disease may occur at any period of life, though it is not common in old age. The analysis of the present series shows three patients under ten years of age (four and one-half, seven, and five years, respectively), nine between ten and twenty, thirteen between twenty and thirty, one between thirty and forty, one between forty and fifty, and one over fifty. Adding to these the result of analysis of 346 cases by Osler and 164 by Nothnagel, we have 538 cases divided as follows: under ten years of age, thirty; between ten and twenty, one hundred and twelve; between twenty and thirty, one hundred and thirty-seven; between thirty and forty, one hundred and twenty-two; between forty and fifty, ninety-three; between fifty and sixty, thirty-one; between sixty and seventy, eleven, and over seventy, two. Between the ages of twenty and forty it is most frequent.

If we may draw conclusions from the cases under consideration, the family history of the patient seems to play an unimportant rôle in the etiology of the disease. In the twenty-eight cases it was noted as entirely negative in twenty-three and as tubercular in only two. The disease itself was mentioned in the antecedents of but one patient (Case X.), whose grandfather is said to have had it.

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A most interesting feature in the history of these cases is the fact that in eleven there is a story of a previous abdominal trouble, apparently inflammatory in its nature. In two, "inflammation of the bowels" (two to three years previously); in six, typhoid fever (4, 3, 12, 1, 14, and ? years previously); in two, previous abdominal operations with drainage, and in one, a previous attack similar to the present. This may not be significant, but it is, at least, worthy of note. The past history of twelve of the cases is negative; in one, phthisis is acknowledged.

Examination of the chest showed probable tubercular affection of the lungs in nine of the patients, and was said to be negative in eleven; in eight, no examination is recorded. Of the nine cases in which the lungs were said to have been affected, four died; autopsy disclosed lung affection in two other fatal cases in which it had not previously been suspected. Of the cases that recovered the lungs had been found negative in seven, affected in one, and not examined in three.

The onset may be acute or gradual. It was acute in thirteen of these cases, gradual in thirteen, and in two could not be classified. In seventeen of the cases pain was the first symptom noticed; in eight malaise, and in two distention. Pain was present during some portion of the course of the disease in twenty-six cases; it was entirely absent in only two. When not the first symptom, it followed after periods varying from a few days to six months (Case VII.). It disappeared before operation in four of the cases (XII.–VI.–XI.–XXV.). Distention was present in twenty-three cases, in two of which it was very slight. It usually came early in the course of the disease, but in two cases was much delayed, appearing in Case VII. one and a quarter, and in Case X., one and five-sixth years after the onset. Abdominal tenderness, loss of flesh and strength, nausea and vomiting and disturbance of the intestinal functions were also prominent symptoms.

Case XIV. is typical of a class in which the disease is acute, both in onset and in course; it may even simulate closely acute appendicitis, as in Case XXVII.; however, it may be almost entirely latent, as in Case XXII., in which,

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though there had been an entire absence of symptoms up to six weeks before operation, yet autopsy disclosed a process which must have been of long duration.

All the cases showed some degree of fever. The temperature was usually irregular, the afternoon rise being fairly well marked. The morning temperature averaged between 99° and 100°, and the afternoon, between 101.5° and 103°. Osler speaks of cases which run a subnormal temperature throughout their entire course. This series offers no example of such cases, though several showed periods of varying duration during which the temperature was subnormal. Pigmentation of the skin was not noticed in any of this series, nor was enlargement of the inguinal glands which Spaeth found in his four cases. The erythema which, in some patients, surrounds the umbilicus and which, when present, is considered pathognomonic by Henry, was not found in any of these.

Aldibert's classification of the various forms of tuberculous peritonitis is accepted by most writers on the subject, and is made use of here. The cases are separated into three divisions, viz.: I. Ascitic. This form may be either acute or chronic: the chronic cases may be either general or encysted. II. Fibrous, which may be either dry or adhesive. III. Ulcerative, which may be either dry or suppurative. Under these headings the present series divides itself into (I.) nineteen cases of the ascitic type, ten of which are acute and nine chronic; of the chronic cases, six were general and three encysted; (II.) seven of the fibrous type, two of which were dry and five adhesive; and (III.) two of the ulcerative type, both of which were suppurative.

A tabular view of the cases and the result of operation is presented:

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Type.	Case Number.	Sex.	Age.	Time between onset and operation.	Drained or closed.	Results of Operation.	
						Immediate.	Remote.
I. ASCITIC.	VI.	F.	14	3 months.	D.	General condition improved; local condition not improved; abdominal pain and distention at discharge, 4 months after operation	Recovery, 3¾ years.
1. Acute.	VII.	M.	40	1½ years.	C.	Improvement in general condition; still some abdominal distention; discharged 17 days after operation	Recovery, 3⅔ years.
	XIII.	F.	20	1 month.	D.	Some pain for 1 month after operation; marked improvement from the first; wound healed. Discharged 76 days after operation	Not traced.
	XV.	M.	12	2½ months.	D.	General condition very good; still has abdominal pain, distention and discharge. Discharged 28 days after operation	Death, 2 months.
	XVI.	F.	28	3 weeks.	C.	Diarrhœa; abdominal pain and distention continued; spontaneous opening of wound 22 days after operation.	Death, 35 days.
	XVIII.	M.	22	13 days.	C.	Improvement generally and locally from the first. Discharged 1 month after operation	Not traced.
	XIX.	M.	5	Operation 80 days after operation for hernia.	C.	Improvement from the first; slight distention remained. Discharged 25 days after operation	Recovery, 1½ years.
	XXI.	F.	12	17 days.	C.	Improvement from the first. Discharged 16 days after operation	Recovery, 1⅔ years.
	XXIII.	M.	21	24 days.	D.	Not much improvement. Fecal fistula 42 days after operation. Discharged 58 days after operation	Death, soon after leaving hospital.
	XXV.	F.	29	9 days.	C.	Symptoms relieved; fluid reaccumulated; second operation 11 days after first; drained. Discharged 79 days later in excellent condition.	Recovery, 1⅓ years.
2. Chronic.	VIII.	M.	4½	2 weeks.	D.	No improvment for 6 weeks; then marked improvement began; slight distention remained. Discharged in good condition 57 days after operation	Death, 4 months.
(a) General.	IX.	M.	23	4 weeks.	D.	General condition improved; still some pain; wound closed. Discharged 26 days after operation	Not traced.
	X.	F.	10½	6 months.	D.	Improvement in every way from first. Discharged 19 days after operation	Recovery, 3⅓ years.

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	XI.	M.	22	35 days.	C.	Fluid reaccumulated: spontaneous opening of wound 23 days after operation; general condition fair; local condition unchanged at discharge, 4 mos. after operation...	Improved, 14 months.
	XIV.	M.	28	26 days.	C.	No symptoms; fluid reaccumulating; general condition good on discharge, 15 days after operation.....	Recovery, 2⅝ years.
	XXII.	M.	60	7 weeks.	D.	Improved generally for a short time; fecal fistula 22 days after operation.....	Death, 6 weeks.
(b) Encysted.	V.	M.	11	10 weeks.	D.	Slight distention for 1 month after operation; wound closed: in excellent condition at discharge, 55 days after operation.....	Recovery, 4½ years.
	XX.	F.	19	1 month.	D.	Local condition unchanged; general condition fair at discharge, 10 weeks after operation. Re-entered 1 month later with fecal fistula; distention, but no pain or tenderness.....	Death, 3½ months.
	XXVI.	M.	31	10 weeks.	D.	General condition much improved; distention remained; wound closed at discharge, 5 weeks after operation.....	Death, 4 months.
II. FIBROUS. 1. Dry.	I.	F.	23	4 months.	D.	Wound closed; great improvement, both locally and generally; no symptoms on discharge, 26 days after operation.	Death, 3 months.
	XXVIII.	F.	19	4 weeks.	C.	Improvement both generally and locally from first; no symptoms on discharge, 30 days after operation	Improved, 10 mos.
2. Adhesive.	II.	F.	19	2 months.	D.	Improved in every way from first: no symptoms on discharge, 40 days after operation.....	Recovery, 5½ years.
	III.	F.	24	3 months.	D.	No improvement; gradually failed; fecal fistula on eighth day after operation.....	Death, 7 weeks.
	IV.	M.	24	6 months.	D.	Slight improvement in general condition after operation; no improvement in local; fecal fistula on sixth day after operation; gradually failed	Death, 3 weeks.
	XXIV.	F.	19	18 days.	D.	Improved both locally and generally from first; indurated tumor to right of wound still to be felt on discharge, 25 days after operation	Recovery, 1⅛ years.
	XXVII.	F.	24	2 days.	C.	Improvement both locally and generally from first. Discharged 23 days after operation	Recovery, 11 months.
III. ULCERATIVE. 1. Suppurative.	XII.	F.	7	months.	D. Post-operation, sinus.	Excellent general condition; sinus still open. Discharged 3½ months after operation.....	Not traced.
	XVII.	F.	22	5 weeks.	D.	No improvement in any way; fecal fistula from the very first.....	Death, 5 weeks.

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The operation itself is usually simple. Incision into the peritoneal cavity, evacuation of the fluid, if any is present, and closure of the wound give as good results as more extentensive procedures. Should the tubes and ovaries, etc., be removed, if affected? Clark's experience has led him to believe that results are just as favorable when these organs are not disturbed. Winckel thinks they should be removed only when their removal can be accomplished easily. The appendix was removed in three of these cases, and the uterine adnexa in one. The post-operative history in all but one differed in no way from that of the other cases. One case, in which the appendix was removed, developed a fecal fistula and died. (Case XVI.)

If the peritoneum covering these organs is affected only as a part of a general miliary tuberculosis of the cavity, there seems to be no good reason why they should be removed. However, if involvement further than this can be discovered, and their removal can be readily accomplished, it would seem wise to remove them. The advisability of the removal of omental masses is questionable. Clark speaks against it. Such masses cannot usually be entirely removed and, even when left in situ, often disappear after the more simple operation. (See Case XXIV.) The same may probably be truly said of infected mesenteric glands. In Case XXVII. but one of the glands was removed, though several were easily palpable. Yet the patient has had no abdominal symptoms since the operation, and at present gives no sign — subjective or objective — of trouble in the right iliac region. Fibrous bands (Case XXIV.) and infiltration of the gut, causing obstruction, demand the same surgical treatment in tuberculous as in other cases.

Bumm of Basel calls attention to the importance of carefully sponging out and drying the peritoneal surfaces. He considers the mechanical irritation curative. Treves avoids sponging and considers it harmful; he also advises against flushing. Herzfeld agrees with Bumm. Abbe thinks flushing out of the cavities with normal salt solution advisable, and this method was used in all the cases under consideration. This detail seems to be of only minor importance.

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The majority of observers now agree that drainage is of no special benefit; sinuses and fecal fistulæ are very apt to follow its use. Eighteen of these twenty-eight cases were drained; in five a fecal fistula followed, four of these died and one recovered; in ten of the eleven fatal cases drainage was employed. The wound was closed in eleven cases; only one died. In one closed case the wound opened spontaneously later, but the discharge never became fecal; in another a fecal fistula developed; in still another reaccumulation of the fluid made a second operation necessary; drainage was then used and recovery followed.

None of these twenty-eight cases died as a direct result of the operation. The mortality from operation alone in reported cases is from 2½ per cent. to 3 per cent.

Fecal fistulæ are very apt to occur in cases of tuberculous peritonitis if the intestine suffers much injury. The frequent adherence of loops of intestines to the parietal peritoneum of the anterior abdominal wall, to the omentum and to each other necessitates great care in the operative technic. Careless attempts to break up adhesions and carelessly made abdominal incisions often result disastrously.

According to Syms, sepsis is not so apt to occur as in operations on the healthy peritoneum. It followed as a direct result of operation in none of these cases. Tuberculosis of the wound rarely occurs. Nausser reports one such case. In Case XI. the abdominal wall was apparently involved in the tuberculous mass. No attempt was made to excise it, and the end result of the case is not known.

The operation seems to do no harm even in unsuccessful cases. Parker Syms does not consider pulmonary affection as a contra indication to operation. Kümmel thinks that the progress of tuberculosis elsewhere is usually retarded and not hastened by the operation. In fact, Delangree believes that disease of the apices, or a serous pleurisy with slight effusion, may be cured by it. It is usually stated that contra-indications are general acute miliary tuberculosis, extensive lesions of the lungs and tuberculosis of the liver, kidneys or intestines. It seems probable that the use of a local rather than a general anæsthetic will permit of the operation being done

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in many of these cases, where otherwise it would be contra indicated.

Immediate Results of the Operation. — The immediate effect is almost always an improvement in the general condition, at least, if not in the local. Twenty of these cases showed immediate improvement in some way; eleven of the twenty were improved both locally and generally; nine were improved in their general, but little, if any, in their local condition. Immediate improvement, however, does not ensure final cure. Of the cases which at first improved in every way, one died later, and two could not be traced. Four deaths occurred among the cases which at first improved in a general way. Of the four cases in which operation caused improvement in no way all died.

Considerable abdominal pain and some degree of abdominal distention is apt to remain for some days or weeks after the operation, even in those cases which ultimately result most favorably. Some post-operative pain remained in nine of these cases; some distention in eleven. Entire absence of abdominal pain and distention was very uncommon even in the most favorable cases when they were discharged from the hospital, *i.e.*, usually about three weeks after the operation. So, the final outcome of a case cannot be well foretold from the immediate results of the operation, though, when the operation is followed by improvement in no way, the outlook is not promising.

The reaccumulation of fluid is not a contra-indication to the doing of a second laparotomy, nor does it mean failure to cure ultimately. In Case XXV. the fluid reaccumulated shortly after the first operation. Recovery followed a second laparotomy. Herzfeld reports three such cases, the exudate reappearing within a month after operation. In each a second laparotomy was done and recovery followed. Case XIV. of this series was discharged three weeks after operation without symptoms, but with sure signs of the reaccumulation of the exudate. He recovered without a second operation.

In most of the cases operation causes a falling of the temperature, — not to normal by any means, — but after the

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operation the temperature, which is usually still more or less elevated, runs at a lower plane than before operation. Most of the cases — even of the most favorable cases — were running a slightly elevated temperature when discharged from the hospital.

More Remote Results of Operation. — What duration of good health after operation shall constitute a recovery? There is certainly danger of reporting simply quiescent cases as recoveries. All cases reported here as recoveries, with but one exception, were in good health one year or more after operation. The one exception — Case XXVII. — shows no symptoms of recurrence eleven months after operation and is classified as a recovered case because the peritonitis was found well localized at the time of operation, and the patient has had no unfavorable symptoms of any kind since. Of the other cases, four are well between one and two years after operation, one betwen two and three years, three between three and four years, one between four and five years, and one over five years. All the fatal cases died within four months after the operation; three died in about a month or in less than that time, four, between one and two months, one, two months after, one, between three and four months, and two, four months after the operation. Hence it does not seem unfair to consider as recovered any case that one year after the operation is well and in which no signs of recurrence can be found.

In two of the patients — Cases XXIV. and XXV. — whom I have classed as recoveries, there was at the time I saw them a slight evening temperature, 99° in one and 99.5° in the other. A single observation of this kind, especially in the absence of all other symptoms, has little significance. But would not even so slight an afternoon rise, if fairly constant, be of some value in deciding whether some perhaps latent focus of tuberculosis still remains? Afternoon temperature was taken in seven of these cases classed as recoveries and was normal in five.

In the cases that recover the results are striking. Seemingly desperate cases have been restored to perfect health, and although Kümmel, Richelot, Welch, Nausser,

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Jordan and Wunderlich have demonstrated anatomical cures (the last named in 19 out of 500 cases), the important thing for us is the clinical cure. In what proportion of cases does it occur? The literature of the subject supplies many answers. Roersch reports 250 cures in 358 cases — 70 per cent. One hundred and eighteen were seen six months, 79 one year, and 53 two years or more after operation. Treves puts the percentage of recoveries at 35; Parker Syms at 30 to 35 per cent.; Mazzoni reports 35 cases with 33 cures — 94.3 per cent. Winckel says we may expect cures in from 70 to 80 per cent. of all cases. König has reported cures in 25 per cent. of his cases. Wunderlich, of his 500 cases, reports cures in 23.3 per cent. of the ascitic variety and 9.8 per cent. of the adhesive variety. To show how statistics may vary even when the truth of the clinical diagnosis has been established by microscopical examination, let us mention Frees' 18 cases and the 29 reported by Herzfeld: in all cases of both series the clinical diagnosis was confirmed by the microscope. Frees reports 33 per cent. of cures, Herzfeld, 62 per cent. Why statistics vary thus widely does not appear. None of these last-mentioned cases are reported earlier than six months after operation; and yet, if we may judge from as few cases as are contained in the present series, fatal cases usually reach their end before that much time has elapsed. But it seems only prudent to wait at least a year before reporting cases as cured. The fact that this has not been done may account in part for the great variation in the percentage of reported recoveries.

Of this series of 28 cases, 11 recovered and an equal number died — a percentage of 39.3 per cent. Two cases (7.1 per cent.) improved, and 4 (14.3 per cent.) could not be traced. Of the 19 cases of the ascitic type, 8 (42 per cent.) recovered, 7 died, 1 improved and 3 were not traced. Three (42.8 per cent.) of the 7 fibrous cases recovered, 3 died and 1 improved. Of the two ulcerative cases 1 died and 1 could not be traced. By most writers the ascitic form is said to give the highest percentage of recoveries following operation; but in this series operation was equally successful in both the ascitic and fibrous type. The prognosis in the ulcerative variety is always bad.

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Of the many other treatments for tuberculous peritonitis, of the many theories as to why laparotomy often cures the trouble, nothing will be said. It may be noted in passing that tapping was tried in six of these cases; in each case the fluid reaccumulated in a very few days.

The importance of early operation, as far as prognosis is concerned, is probably not great. The average time from the onset of symptoms to the time of operation in this series is practically the same in the fatal cases as in those that recovered. The comfort of the patient is, of course, to be considered.

To summarize briefly:

1. We may reasonably expect cures (one year or more after operation) in from 30 to 40 per cent. of all cases. Fatal cases usually die within a few months after operation.

2. Family history does not appear to be important etiologically. Previous inflammatory affections of the abdominal viscera may have etiological significance.

3. Operation usually affords at least temporary improvement either locally or generally, even in cases that later prove fatal. The use of drainage should be avoided, when possible.

4. Inferences as to the remote results of operation should be drawn very guardedly, if at all, from the immediate results; though in cases which do not immediately receive from an operation either local or general benefit, the prognosis is very unfavorable.

. . . . . .

The writer acknowledges his great indebtedness to the gentlemen of the staff for their courtesy in allowing him to use the records of the cases which were under their care.

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XI.

A GROUP OF UNIQUE AND UNUSUAL SURGICAL CASES.

By George H. Monks, M.D.

The following cases are reported with the permission of the surgeons on whose services they belonged, and of Dr. Mallory who performed the autopsies in two of the cases.

Case I. — The voluntary introduction of hat-pins into the abdominal wall.

A single woman of twenty-one, well developed and well nourished but mentally stupid, entered the hospital (service of Dr. Post) on July 3, 1900. A month or so before this she had introduced a long hat-pin into the abdominal wall, and broken off the head, leaving the shaft of the pin imbedded. For a long time she had been in the habit of masturbating by massage of the ovaries through the abdominal wall, but, as this finally failed to give her satisfaction, she introduced the hat-pin, as already described. The general direction in which the pin was pushed was downwards towards the ovaries. Somewhat later three more pins were introduced, the heads being broken off, and the shafts left buried in the flesh. Two of these were pushed into the abdominal wall and one into the right thigh. Soon after this chills developed, with fever, nausea, and vomiting, associated with considerable pain in the abdominal wall and thigh, where the pins lay imbedded.

In this condition the patient was brought to the hospital. The position of the pins having been determined by the reddish points of entrance on the surface of the skin, the localized resistance on palpation, and more exactly by a skiagraph, the patient was etherized, and they (four pins) were removed by Dr. Post. (See Fig. 1.)

Apparently none of the pins had entered the peritoneal cavity. The line, which appears dotted on the diagram near to the umbilicus, was so very faint in the skiagraph, and, as no point of entrance for

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a needle could be found, and no resistance made out by palpation, it was assumed that the line on the skiagraph had really no significance;

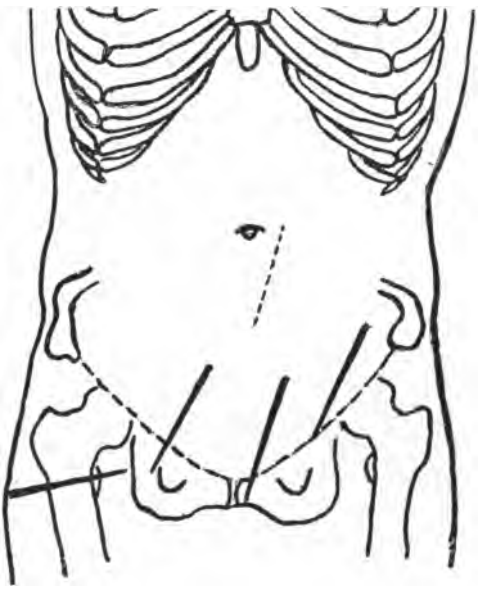

FIG. 1. — Diagram showing the positions of the four pins (black lines) as determined by the skiagraph. The dotted line near the umbilicus is the "faint line" referred to in the text.

that there was no needle in that locality. Farther search was therefore abandoned. The patient made an uninterrupted recovery.

CASE II. — RUPTURED ANEURISM OF THE ABDOMINAL AORTA.

A colored man, thirty-six years old, entered the service of Dr. Gavin on May 19, 1900. He had been a waiter, and was unmarried. It appears that about three months before coming to the hospital he first noticed a swelling in the abdomen. This swelling increased in size up to the time of his entering the hospital.

On the left side of the man's abdomen, and extending from the costal border to Poupart's ligament, was a firm tumor — not movable, not tender. It had a distinct expansile pulsation. It was dull on percussion, and nothing definite could be heard on auscultation.

The man lay in bed, in the left lateral decubitus, with his left hip slightly flexed on the abdomen. The knee also was flexed. The left thigh and leg were both considerably swollen, the circumference of the former being two and one-half inches greater than that of the right thigh. When the left leg was moved it apparently caused considerable pain. Pulsation of the left femoral artery could not be felt.

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At four o'clock on the second morning after admission, without warning, collapse took place, and the patient died in a few minutes.

FIG. 2. — Photograph of the thoracic and abdominal cavities after everything has been removed except the aorta, the tumor, and the left kidney. The aorta has been split open, and on its posterior wall is seen the opening referred to in the text. The left kidney lies in front of, and above, the tumor, it being the most highly illuminated part of the mass on the left side of the abdomen. A director is placed in the left common iliac artery.

The following is a digest from the records of the autopsy made by Dr. Mallory:

Abdominal Cavity. — A number of dark, stringy clots of blood lie over the stomach, omentum, and coils of intestines; also some serous

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fluid, which has evidently been squeezed out of the clots. A tumor (an aneurism), which was not noticed on external examination, is on

FIG. 3.

the left side of the abdominal cavity, almost completely filling it. The descending colon and sigmoid flexure lie over the top of the mass, and have been pushed almost to the median line. The aneurismal tumor

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extends from Poupart's ligament to the insertion of the diaphragm around the vertebral column. The various organs are now removed, one after the other, until finally nothing but the tumor and the aorta are left. The left kidney is now discovered to be on the upper surface of the tumor, shoved up beneath the diaphragm. On opening the aorta it shows some thickening of the intima, but no marked degree of chronic endarteritis. In the posterior wall of the upper part of the abdominal portion is an opening 4 cm. in length by 2 cm. in width. This opening lies on a level with the body of the twelfth dorsal vertebra. The edges of this opening are rounded, and the intima extends into a cavity which lies behind the aorta. (See Figure 2.)

The bodies of the twelfth dorsal and first lumber vertebræ are irregularly eroded, in places to a depth of over 2 cm. (See Fig. 3.) When the finger is passed through the hole in the back of the aorta it enters a huge cavity in the left psoas muscle, which muscle is distended into a thin membrane over the anterior surface of the aneurismal mass. The hemorrhage into the abdominal cavity would seem to have come from that part of the aneurism which was near the diaphragm, but the exact point of rupture cannot be determined.

CASE III. — ENLARGED BURSA OVER THE EXTERNAL MALLEOLUS.

A man of thirty-two, a roofer by trade, noticed, some two months ago, a swelling over the outer malleolus of the left foot. He had been in the habit, while at work on roofs, of sitting cross-legged, and it was to this habit that he attributed the swelling. Two days before he came into the hospital — which was on June 18, 1900 — he noticed that there was considerable pain in the swelling, and that it had increased rapidly in size. He therefore applied for admission, and came upon Dr. Gavin's service. (See Fig. 4.)

The diagnosis of subacute bursitis was made, and five days later, after the inflammation had subsided, Dr. Blake dissected out the sac, which contained a clear gelatinous fluid. The wound healed by first intention, and on June 30 the patient was discharged, well.

In England, where this condition is quite frequently seen, it is often spoken of as "tailor's bursa." Of course, enlargement of this bursa may be developed in any occupation where the habit of sitting cross-legged is much practised. I have never before seen it in a roofer.

CASE IV. — SYPHILITIC STRICTURE OF THE ŒSOPHAGUS.

A bar-tender, fifty-three years of age, and single, entered the hospital April 30, 1900, on the service of Dr. Cushing. His father had

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died of phthisis, and his mother of Bright's disease. Five months before entrance his present illness had started. He began to have pain after eating solid food, accompanied with nausea and vomiting. These symptoms not only persisted but increased up to the time of admission. Because of the distress which he knew it would cause

FIG. 4.

him, he refrained from taking any solid food for two or three months, during which time he took only milk and whiskey. Two months before he had vomited a mouthful of dark-colored blood, and fifteen days before a little more. There had been much loss in weight, constipation, cough with yellowish expectoration, anorexia, and

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constant thirst. The diagnosis of stricture of the œsophagus was made. Gastrostomy was performed by Dr. Munro, and the patient was made tolerably comfortable for a while by feeding through the gastric fistula; but eventually he died, apparently from inanition.

The following is a digest of such part of the autopsy records as apply to the condition of the œsophagus. The autopsy was made by Dr. Mallory. The oesophagus is practically normal, except at the lower end, where it is constricted. The centre of constriction lies 2.5 cm. to 3.5 cm. above the irregular termination of the œsophageal epidermis. A small probe can with difficulty be passed through the opening. Examination of the stricture, after opening the œsophagus, shows a deep ulceration 2.5 cm. long, the long axis of which corresponds to the long axis of the œsophagus. It measures 1 cm. in width. Its base is clean, irregular, and fibrous in appearance. The epidermis covering the stricture and its immediate neighborhood is macerated off, so that the rest of the mucous membrane appears grayish and smooth, or yellowish and slightly ragged. The portions of epidermis remaining are white and opaque. The wall of the ulcer is very dense, and at the point of greatest thickness it measures 8 mm. The edge of the ulceration is soft, and not in the least elevated above the surrounding mucous membrane. The ulceration and the surrounding indurated tissue take up all but 12 mm. of the circumference of the œsophagus at its narrowest point. The anatomical diagnosis made at the autopsy was *syphilitic ulceration and stenosis of the œsophagus.* In addition to this there were also evidences of the following, viz., syphilitic epiglottiditis, healed tuberculosis of lungs, chronic pleurisy, chronic nephritis, calculus of kidney, chronic interstitial orchitis, brown atrophy of the heart, etc., etc.

CASE V. — CONGENITAL DEFORMITY OF THE RIGHT THUMB.

A male cook, fifty-three years of age, came into Dr. Cushing's service, April 10, 1900, for the treatment of an extensive varicose condition of the left leg. While the examination was being made it was casually noticed that the man had a congenital deformity of one of his thumbs. With his consent a photograph and a skiagraph were taken of the deformity, and they are here reproduced. (See Figures 5 and 6.)

CASE VI. — EVISCERATED VENTRAL HERNIA.

The patient was a woman of forty-eight, a domestic. She had been operated upon some two years previously for some abdominal trouble, the exact nature of which does not appear. Soon after the operation the scar of the abdominal wound (which was in the median line, between the umbilicus and pubes) began to stretch, and the patient soon had a fully developed ventral hernia. This

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FIG. 5.

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FIG. 6.

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hernia became irreducible, but no special attention was paid to it, until finally the sac ruptured, and the bowels came through the rent and rested upon the abdomen. The woman wrapped a towel about the mass, and in this condition remained several hours at home, before coming to the hospital.

She was admitted to my service, October 29, 1900, at which time she was in a condition of profound shock. The pulse at the wrist was scarcely perceptible, and soon disappeared entirely. The surface of the body, though at first somewhat warm, rapidly cooled, and became covered with a profuse, clammy sweat. The expression of the face was anxious. On the lower part of the abdomen, just above the pubes, protruding through the rent in the hernial sac, was a large mass made up principally of small intestines, some of them reddish-blue in color, and granular, and the others covered by a grayish membrane and lightly adhering to each other. Considerable sero-purulent fluid was oozing around the neck of the mass, apparently escaping from the abdominal cavity.

The patient did not react very well to stimulants, but in spite of this, in view of the urgent nature of the case, an attempt was made, by Dr. Lothrop, at the request of the patient's son, to replace the mass under ether. The ventral opening in the median line was enlarged upwards, the whole mass thoroughly irrigated with warm salt solution, and replaced. A few temporary sutures brought the abdominal wound together. Stimulation was given throughout, and large quantities of salt solution injected under the breasts. The patient failed to rally, and she died quietly a few hours after the operation.

Case VII. — Wound from a rifle-bullet which traversed the chest. Recovery.

A strong and well-developed man, of twenty-six, was accidentally shot in the chest, while engaged in rifle practice at target. This was on August 21, 1900. He was brought to the hospital half an hour later, and assigned to my service. The bullet, of 22 calibre, had entered his chest at the spot shown in Figure 7. The direction of the bullet is roughly indicated by the direction of the small stick of wood placed upon the chest. (See Fig. 7.)

There had been a slight hemorrhage from the wound of entrance, some hemoptysis and considerable dyspnœa. When the man entered the hospital his pulse was 72, and of good character. There was moderate shock; the face was pale, and the expression somewhat anxious. The skin was covered with a cold sweat. In front of the first intercostal space, about one inch to the left of the sternum, was the bleeding wound of entrance. This was about 7 mm. in diameter. No scorching or discoloration of the skin from powder. No emphysema. In the back was a small area of emphysema about

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four inches in diameter, and in the centre of this was another small wound, very close to which could be distinctly felt under the skin a small conical bullet of about 22 calibre. Such examination of the chest was made as was deemed advisable under the circumstances. The right side of the chest was negative; on the left side there was dulness, almost to flatness, beginning in the mid-axillary

FIG. 7.

line and extending towards the back, throughout the whole extent of the pleural cavity. Backs not examined. Heart not displaced. During the examination a slight cough, causing much pain, brought up a little fresh blood. It was thought best to leave the bullet undisturbed. Heaters were placed about the man, and he was kept quiet by morphine. For the first ten days or so after the accident the temperature was raised, and respiration was slightly accelerated. There

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was some pain in the left side, especially along the track of the bullet, and occasional cough with expectoration of a small amount of blood. The pulse, however, remained nearly normal throughout. On August 31, ten days after the accident, the patient was quite comfortable.

Fig. 8.

No unpleasant symptoms present, except a slight cough with occasional mucous expectoration, and a little blood. Examination of the affected side of the chest showed less mobility than on the other, or sound, side. There was also dulness below a line drawn around the chest from the third rib in front to the spine of the scapula

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behind. Over this area there was a diminished respiration, and occasional fine moist râles could be heard. Vocal and tactile fremitus absent. Above the area of dulness the respiration was harsh, and a few râles could be detected.

Fig 9.

On September 6 the distorted bullet and two small chips of lead were removed from the back, under cocaine anæsthesia. The wound was stitched up, and it healed by first intention. Soon after this the man sat up, and a few days later left the hospital. There were

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still a few signs of trouble in his lungs, though all the annoying symptoms had disappeared.

When one considers the important anatomical structures in or about the track of the bullet the man's escape seems truly marvellous.

Case VIII. — Emphysema of the entire surface of the body, following fractured ribs.

A man of seventy was knocked down by a runaway horse and carriage, on August 29, 1899. He was brought into the hospital a few hours later, and was assigned to my service.

He was thin and old-looking, his color pale, and slightly cyanotic; the respiration was rapid and shallow, and the pulse 80 and weak. On the right side of the chest, over the seventh and eighth ribs in the posterior axillary line, was an abrasion as large as a silver dollar. The chest wall in the immediate vicinity of this, over an area about as large as the palm of the hand, rose and fell with respiration. Here, and indeed nearly everywhere on the back, the front of chest, and hands, spongy swellings were present and air crepitus could be felt. Cavernous respiratory murmurs and near voice sounds were heard over the site of the contusion on the chest. It was perfectly evident that several ribs were fractured, but a thorough examination was not possible, on account of the serious nature of the case, and also because of the great tenderness. A broad plaster swathe was put about the patient, and a bed-rest placed at his back, — thus enabling him to occupy the position in which he seemed to be most comfortable. Heaters also were applied.

The day after the accident the emphysema had extended to the knees, forearms, hands, face and neck. The pulse was thirty-two, and labored. There was considerable pain in the right side of the chest. On the next day the distention was even greater, the patient appearing tremendously bloated all over except on the scalp and legs and feet; the skin was very shiny from distention; and there was some cough and bloody expectoration.

The emphysema continued to extend, and on September 2 — the fourth day after the accident — reached its maximum, and both eyes were closed. At this time air-crepitation could be felt all over the patient's body. The next day the emphysema was less marked; the left eye-ball became visible; there was some cough and purulent expectoration. (See Fig. 8.)

From this time the patient's condition began to improve; the emphysema diminished, and he became more comfortable. On September 20 — about twenty-two days after the injury — the emphysema had practically disappeared, and he had returned to — what might be called — his original condition of thinness. (See Fig. 9.)

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On October 3 the patient felt fairly well and strong. There was still slight emphysema over the seat of the fractured ribs, but no bony crepitus could be felt. There was occasional cough, with small amount of sputum. On this day the patient was discharged. About two months later he reported at the hospital. He seemed well and even vigorous, and declared that he had no pain, dyspnœa or cough, or any troublesome symptoms whatever.

At the time when this case was under observation, it seemed to me that it was distinctly unique. I have since then met, however, references to two cases in medical journals, and have had my attention called to another by one of my colleagues; and yet, I think the case is sufficiently unusual to warrant publication, especially as the contrast between the photographs is so striking.

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XII.

THE WORK IN SURGICAL PATHOLOGY OF THE PATHOLOGICAL AND SURGICAL DEPARTMENTS.

By M. F. Gavin, M.D.,
with the assistance of L. R. G. Crandon, M.D.,
W. C. Howe, M.D., and D. D. Scannell, M.D.

During the past few years the Surgical Department, in view of the rapid advance of morbid histology, has come to ally itself more and more closely with the Pathological Department. Under the supervision of Dr. Councilman and Dr. Mallory at the Pathological Laboratory of this hospital the examination of surgical material has been developed to a system which satisfies the demands of both surgeon and pathologist. For two years now the major part of the work has been done by surgical externes, one of whom has volunteered each six months. By this arrangement the externe, about to become a surgical house officer, gets a training in gross and microscopic pathology that is of great practical value to him.

This paper is intended to serve as an exposition in general of the relations between the Surgical and Pathological Departments, and in particular to review the work done by the Laboratory for the Surgical Department during the last eighteen months. The arrangements by which specimens are collected, are conveyed to the Laboratory, and are listed, are of first interest.

Each specimen as soon as it is removed in the operating-room is wrapped in moist gauze and oiled paper, and is carried to the Laboratory within an hour — or immediately if a diagnosis is needed at once. Accompanying each specimen is a printed slip, of which the following is a copy, filled in with a typical case:

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S.00.641.

REPORT FOR THE PATHOLOGIST.

THE BOSTON CITY HOSPITAL.

Date, November 1, 1900.

Name, John Smith.

Sex, male Age, 23 years.

first Surgical Records, Vol. A 351 P 30.

~~Medical Records, Vol. , P.~~

Ward B Bed 27

Organ or tissue involved, cervical lymph node.

Duration of Disease, six months.

Clinical History in Brief, gradually increasing, fairly firm tumor in left side of neck, over sterno-cleido-mastoid muscle: slightly tender, not adherent to skin, movable over deep structures.

Clinical Diagnosis, Chronic inflammatory. Tuberculosis?

Diagnosis of Pathologist. Tuberculosis.

Signed,

J. B. Mallory. Pathologist.

[5M.7.'99.]

INSTRUCTION TO HOUSE OFFICERS.

All tissues for examination must be wrapped in moist sterile gauze immediately after operation, and delivered within one hour at the Pathological Laboratory.

Cultures should be delivered at the Laboratory before 4 o'clock, in order to insure a report the following day.

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At the Laboratory the specimen is given a series number, and this number, with date, patient's name, surgical service, the tissue involved, and ultimately the diagnosis, is entered in the catalogue for ready reference. This sheet catalogue is exemplified in the following:

S.00.641 Nov. 1. John Smith, i surg., cervical l. n., tuberculosis.
S.00.642 Nov. 1. Peter Olson, iii surg., appendix, ac. appendicitis.
S.00.643 Nov. 2. Helen Stewart, ii surg., breast, carcinoma.

The series number is entered on the original slip accompanying the specimen; in the system of numbering specimens the S distinguishes the case as surgical apart from bacteriological and autopsy material; the 00, 99, or 01 stands for the year, and the number is the serial number for that year, a new series beginning every twelve months.

A description of the gross appearance of the specimen as it is, and as it may appear on section is then written; the point of view being always objective. In other words, a description of the physical properties of the specimen, namely, its size, shape, color, "feel," consistency, character of surface, etc., is written, rather than more or less vague comparisons with a variable norm. Careful measurements in the metric system are recorded. Comparisons with common objects are not made.

Certain specimens require immediate diagnoses. For example, on the nature of a tumor of the breast may depend the question of either a complete dissection of the axilla and removal of the pectoral muscles, or simple excision. In such a case the excised tumor is taken to the Laboratory, a section of it is made by the freezing microtome, stained with methylene blue, diagnosis made and returned to the operating-room. Such a diagnosis may be returned to the surgeon in four minutes.

There is a second class of cases demanding speedy diagnosis, in which the question is one of a further and more complete operation, or the discharge of the patient from the hospital, but permitting the use of the twenty-four hour method. This provides for the preservation of a permanent microscopic specimen. In this class come uterine scrapings

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and other cases in which the surgeon asks for a quick diagnosis. This method requires passing a representative piece of the original material, not more than two millimetres thick, through five solutions, viz., ten per cent. formalin in alcohol, ninety-five per cent. alcohol, absolute alcohol, alcohol and ether, thin celloidin; cutting, staining in alum hæmatoxylin and eosin, and mountng.

All other specimens where examination is to be made for completeness of clinical or pathological record, or for the sake of scientific observation, are first hardened in Zenker's fluid for twenty-four hours, washed in running water for twenty-four hours, put in eighty per cent. alcohol for twenty-four hours, and then carried successively for twenty-four hours each through ninety-five per cent. alcohol twice, absolute alcohol, alcohol and ether, thin celloidin, and thick celloidin, and mounted as before. Particular specimens where serial sections may be of value, or those of which photomicrographs are to be taken, are put through the paraffine method.[1]

The remaining gross material, if it is of value for teaching purposes, or if further examination may be necessary, is preserved in alcohol. Certain specimens of unusual occurrence or interest are preserved in Kaiserling's solution.

To each bit of tissue during fixing and hardening in the successive bottles is attached a small slip of gummed paper with the serial number written on it. By this device many specimens may be carried through one set of bottles at one time without chance of confusion.

A description of the microscopic appearance of each slide prepared as above is next made, and put with the gross description of the original specimen in typewritten records. The diagnosis for the official return is made by the Resident Pathologist and confirmed by the Visiting Pathologist on duty. The diagnosis is filled in on the original slip and returned to the surgical service; the slip is ultimately pasted in the clinical records.

One or more microscopic slides from each case is preserved in serial order in a cabinet of drawers.

Cultures from wounds, body cavities and pus, are made, examined and recorded by the same system.

[1] Vide Mallory and Wright, "Pathological Technique."

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It may be readily seen that by this double method of record-keeping either surgeon or pathologist may easily find the clinical record, the pathological record, or the specimen.

The amount of surgical material examined in the laboratory is constantly increasing, as may be seen from the following:

January 1 to June 30, 1899, 361 specimens were described.

July 1 to December 31, 1899, 412 specimens.

January 1 to June 30, 1900, 433 specimens.

The following is a tabulated list of the cases for eighteen months preceding June 30, 1900:

TUMORS;

Of Skin —

Epidermoid carcinoma	43
Epidermoid carcinoma, rodent ulcer type	8
Small round-celled sarcoma	2
Spindle-celled sarcoma	2
Fibro-chondro-sarcoma	1
Angio-sarcoma	1
Angio-fibro-sarcoma	2
Endothelioma	3
Fibroma	9
Papillary fibroma	5
Fibro-lipoma	1
Keloid	2
Myoma	1
Dermoid cyst	7
Hæmorrhagic cyst	1
Sebaceous cyst	2
Branchial cyst	2

Of Subcutaneous Tissue:

Lipoma	10
Spindle-celled sarcoma	1
Mixed-celled sarcoma	4
Myxo-sarcoma	1
Perithelial angio-sarcoma	1
Perithelial lymphangio-endothelioma	1
Endothelioma	1
Fibro-angioma	1
Fibroma	1
Fibroma with acute ulceration	1

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Of Digestive Tract:

Mouth,

Lip —

Epidermoid carcinoma	8

Buccal mucous membrane —

Epidermoid carcinoma	3

Tongue —

Epidermoid carcinoma	1

Jaw —

Carcinoma	3
Giant-celled sarcoma	1
Round-celled sarcoma	1

Palate —

Carcinoma	1
Sarcoma	1

Tonsil —

Fibro-lipoma	1
Epidermoid carcinoma	4
Malignant lymphoma	3
Papilloma	1

Oesophagus —

Epidermoid carcinoma	1

Stomach —

Carcinoma	2

Small intestine —

Carcinoma	1
Malignant adenoma	3

Large intestine —

Carcinoma	1
Colloid carcinoma	2
Malignant adenoma	2
Adenoma (benign)	1
Small-celled sarcoma	2
Rectal polyp	2
Condyloma	1

Liver —

Carcinoma	1

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Peritoneum —
Myxo-sarcoma 1

Mesentery —
Sarcoma 1

Omentum —
Scirrhous carcinoma, with colloid degeneration (primary focus not determined) 1

Of Respiratory Tract:

Nares —
Papilloma 7
Fibroma 2

Naso-pharynx —
Fibro-sarcoma 1
Adenoids 1

Larynx —
Carcinoma 2
Papilloma 1

Trachea —
Colloid carcinoma 1

Pleura —
Mixed-celled sarcoma 3

Of Urinary Tract:

Kidney —
Hydronephrosis 1

Bladder —
Carcinoma 2
Epidermoid carcinoma 1
Malignant adenoma 2

Prostate —
Fibro-myoma 3
Adenoma 1
Adeno-carcinoma 1

Penis:
Epidermoid carcinoma 4
Papilloma 2

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Of Genital Tract:	
Testis:	
Sarcoma	4
Gumma	1
Epididymis:	
Hydrocele	12
Simple cyst	1
Of Female Genitals:	
Uterus:	
Fibro-myoma	23
Fibro-myoma with chronic salpingitis	2
Fibro-myoma with acute suppuration	1
Carcinoma	12
Malignant adenoma	2
Adeno-carcinoma	2
Simple cyst	1
Polypus	1
Cervix uteri:	
Carcinoma	4
Epidermoid carcinoma	2
Vagina:	
Carcinoma	1
Polypus	2
Oviducts:	
Malignant adenoma	1
Ovaries:	
Malignant adenoma	1
Dermoid cyst	4
Adeno-cystoma (multilocular)	15
Teratoma	1
Broad Ligament:	
Parovarian cyst	8
Parovarian cyst with atrophy of oviduct	1
Of Glands:	
Female Breast:	
Carcinoma	34
Adeno-carcinoma	2
Intracanalicular adeno-fibroma	1
Intracanalicular papillary fibroma	3
Sarcoma	1
Adeno-myxoma	1
Lipoma	2

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Parotid:	
Epidermoid carcinoma	1
Simple cyst	1
Of Ductless Glands:	
Thyroid:	
Adeno-cystoma	2
Adrenal:	
Tumor	2
Of Lymph Nodes:	
Carcinoma (secondary)	12
Mixed-celled sarcoma	2
Lympho-sarcoma	3
Adenoma (secondary)	1
Of Bone:	
Mixed-celled sarcoma	2
Spindle-celled sarcoma	1
Chondro-sarcoma	2
Giant-celled sarcoma	1
Osteo-sarcoma	2
Osteo-chondroma	1
Osteoma	1
Exostosis cartilaginea	2
Of Blood Vessels:	
Hæmangioma	3
Varicocele	7
Hæmorrhoids	24
Varicose veins	6
Urethral caruncle	1
Of Nerves:	
Amputation neuroma	1
Of Eye:	
Melanotic sarcoma (secondary to focus in liver)	1
INFLAMMATORY:	
Tissues showing acute inflammation	37
Tissues showing chronic inflammation	119
Granulation tissue	33
Scar tissue	18

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Appendicitis:	
Acute	42
Acute perforative	31
Chronic	36
Tuberculosis of Appendix	2
Salpingitis:	
Acute	18
Chronic	83
Hydrosalpinx	3
Tuberculosis of oviduct	4
Oöphoritis:	
Acute	2
Chronic	2
Abscess of ovary	3
Endometritis:	
Acute	4
Hyperplastic	44
Lymph Noditis:	
Acute	4
Gonorrhœal	1
Tuberculosis of lymph-nodes	22
Acute osteomyelitis	9
Chronic osteomyelitis	3
Chronic mastitis	8
Neuritis	3
Bursitis	4
Endarteritis	1
Pancreatitis	1
Ophthalmitis (acute suppurative)	1
Tuberculosis of ciliary body of eye	1
Chronic leg ulcer	2
Products of Gestation —	
Decidua	32
Placenta	7
Extra-uterine pregnancy	6
Fœtus	3
Tuberculous tissue	39
Tuberculous bone	12
Actinomycosis	4
Emphysematous gangrene (due to bacillus aërogenes capsulatus Welchii)[1]	2

[1] One of these cases reported by Paul Thorndike, M.D., in Bos. Med. and Surg. Journal.

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Aneurism	2
Gangrene of limbs	7
Mesenteric thrombosis	1
Necrotic tissue	16
Intussusception	1
Ruptured spleen	1
Filaria sanguinis hominis [1]	1
Tissues presenting nothing abnormal	106
Total specimens examined in eighteen months	1,206

It is obvious that in a paper of this kind lack of space forbids report of any considerable number of cases. The following selected cases are cited to show the amount of detail recorded in gross and microscopic examination.

S. 99. 480. Tumor of Adrenal—

Gross. Kidney with tumor mass adherent. Kidney measures 10 x 5 cm. At both extremities of the kidney cortex and pyramids are visible. Elsewhere the growth has invaded the kidney and extends to the capsule, no trace of renal substance remaining. The tumor mass is spheroidal in shape, and measures 14 x 10 cm. It is covered by a thin, smooth, glistening, richly vascular capsule. On palpation the mass is semi-fluctuant, elastic. On section, the mass is reddish gray in color, pulpy, and falls apart by its own weight. In places are small areas of hemorrhage near the periphery; adjacent to the kidney is a large area of œdematous necrotic tissue. The general appearance is that of blood-stained, softened brain tissue. Adrenal gland cannot be found.

Microscopic. Section consists of portion of cortex of the kidney and adjacent new growth. The new growth consists of large alveoli of cells suggesting the cortical cells of the adrenal. The narrow alveolar walls consist of dense fibrous tissue showing remnants of renal tubules. Considerable infiltration with lymphoid cells in the alveolar walls and surrounding kidney tissue. From the alveolar walls septa pass into the alveoli, giving the cells an arrangement suggesting the glomerular and fascicular arrangement in the cortex of the adrenal. Slight hemorrhage among the alveolar cells.

S. 99. 77. Tumor of Adrenal—

Gross. A mass 15 x 17 x 7 cm. Uneven, nodulated, its surface being in places bloody, dark red, white and fibrous and cream-yellow, with no regularity. One area 5 x 3 cm. seems like normal kidney capsule, with tissue more or less like kidney beneath. On section,

[1] Case reported clinically and pathologically in Amer. Journal Med. Sci., by Howard A. Lothrop, M.D., and Joseph H. Pratt, M.D.

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at one end of its largest diameter is a narrow strip of tissue which shows kidney cortex three or four cm. wide, slightly rough on the cut surface, and below it pyramidal markings; below this zone are several cysts, 1, 2 or 3 cm. in diameter. Below this the whole mass is a densely firm, deeply cream-colored tissue, containing many vessels, here and there a jelly-like substance. In the lower part is a more or less spherical mass, dark brown, bloody, soft, crepitant. No odor. Total weight, 1,450 grms.

Microscopic. Shows (A) on one edge kidney cortex containing glomeruli larger than usual, having a normal number of nuclei; the capsule normal; interlobular substance increased and cellular; tubules small, their epithelium granular; their lumina in many places containing granular material. Vessel walls are thick. The cortex is broader than usual, and is limited externally by a fairly wide band of dense, fibrous, connective tissue. Outside, the tissue consists of large, angular, densely packed cells, intersected irregularly by narrow bands of fibrous tissue. These cells have relatively small nuclei and a granular cytoplasm. In places there is necrosis. In other places, section (B) shows a structure like the above, but the cell protoplasm has more or less disappeared, leaving only a network of granular detritus within the cell membrane, causing the cell to be very refractive — the contour of the cell remains as before. Here also are seen cells containing large and small droplets of hyaline material. The blood vessels are small and thin-walled. Here and there small foci of lymphoid cells with a few plasma cells are seen. The periphery of the tumor shows a distinct capsule.

S. 99. 443. Tuberculosis of Ciliary Body of the Eye —

Gross. Specimen consists of globe of the eye showing anterior staplyloma of the sclera. Specimen hardened in toto in formaldehyde.

Microscopic. The ciliary processes and the anterior portion of the sclera are replaced by tuberculous tissue which also fills and distends the anterior chamber and encroaches upon the cornea. The tissue consists of epithelioid and lymphoid cells, with many huge giant cells scattered through it. In places there is slight infiltration with polynuclear leucocytes. In some of the giant cells the nuclei have a mural arrangement, in others they are scattered through the protoplasm. The tuberculous tissue in no place breaks through the external tissue of the eyeball, but it comes to the surface near the junction of cornea and sclera. Pigment is diffused through the ciliary processes, occurring in the epithelioid and giant cells.

S. 99. 392. Osteo-cheondroma of Tibia —

Gross. The specimen consists of right foot and leg, and lower fourth of right thigh. The foot and lower two-thirds of leg show nothing abnormal; knee joint normal. On the inner aspect of the

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upper third of the tibia is a dense resistant tumor, over which the skin is freely movable, connected with the bone. The tumor mass extends posteriorly, apparently nearly encircling the shaft. (The knee joint was opened, and the femur with superficial parts separated from the tibia. The superficial and deep muscles covering the shaft of the tibia were dissected away; the tumor mass was found to have no connection with the muscles covering it; the muscles had been pushed backward by it. Frontal section was made of the shaft of the tibia and tumor.) Tibia inside. Shaft outline perfectly preserved. 18 cm. below upper end of the tibia the marrow is yellow and normal in appearance. For 2 cm. above this point it appears like red cancellated bone tissue. Above this is an irregular cavity 1 cm. in greatest diameter; walls reddish. Above this and separated from it by a narrow bony bridge is another small cavity containing soft pinkish tissue. Above this point the medullary cavity is filled with dense bone-like material, apparently as hard as the cortical bone.

The surface of this dense bone-like material varies a good deal in color; yellowish white, translucent — yellowish, more opaque; pink.

Tibia, outside. Tumor mass begins on inner aspect of shaft 4 cm. from upper end and extends downwards to a point 17 cm. below upper extremity. The color is pinkish white with lines of white radiating from a point about 10 cm. below upper extremity of tibia. The tissue is dense and hard; near the shaft it shows more calcification than farther out. The outer border is softer, gray and translucent for 1 or 2 mm. The density of the tumor mass outside of the limits of the shaft is much less than that of the calcified tissue within the shaft. At the lower end the growth merges gradually into the line of the shaft; apparently it is extending beneath the periosteum. At the upper end the tumor extends higher than its point of attachment to the shaft. The tumor extends nearly around the shaft; anteriorly it seems to extend within 1 cm. of the tibial crest; posteriorly it reaches to within 1.5 cm. of the crest.

Microscopic. Sections show chiefly hyaline cartilage, with numerous small, irregular areas of bone, newly formed from the cartilage. In places the cartilage is very atypical; the cells numerous, the intercellular substance almost absent. The size and arrangement of the cells vary greatly; many are irregular in outline, often stellate; some of the cells have capsules, the majority do not.

S. 99–185 — Anat. Diag. Hydrocele — Chronic Inflammation, Involving Epididymis.

Gross. Three pieces of a sac wall, 8 × 5, 7 × 4, and 5 × 2 cm., respectively, and 3 mm. thick. Outside is wrinkled, shining, and light pink; inside has many layers of thin, slimy membrane attached to it. In other parts the inside is rough with fibrin and blood. On

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section the wall is firm, white, glistening, and shows occasional light brown areas in it.

Microscopic. Shows dense fibrous tissue, hyaline in places, in places rather cellular, with occasional areas and streaks of plasma cells and polynuclear leucocytes. All through the wall are groups of epididymal ducts lined by columnar epithelium, the lumina containing granular matter, but no recognizable spermatozoa.

S. 99-223 — Anat. Diag. — Chronic Hydrocele.

Gross. Irregular soft mass, 8 × 4, 5 × 3 cm. containing within it at one pole a normal feeling testis 4 × 3 × 3 cm. which on section teazes readily. Arising from the longitudinal fold between testis and epididymis on both sides is a tough, wrinkled, granular sac, 2 mm. thick in wall, the whole being the size of the testis with the testis protruding into it. Epididymis appears normal.

Microscopic. Inner wall of epididymis merges into outer wall of sac. This sac is made up of hyaline fibrous tissue, a considerable number of small vessels and occasional clumps of lymphoid cells. The outer folds of the sac contain striped muscle bundles cut across and longitudinally, all outside the hyaline fibrous tissue. Epididymis shows normal ducts containing many spermatozoa. Tubules of testis in active spermatogenesis. Intertubular connective tissue somewhat increased and forming a loose mesh. (Œdematous.)

S. 99-82 — Anat. Diag. — Chronic Interstitial Orchitis, with Gumma.

Gross. A testis, 4 × 2 × 2 cm., covered by a thick, dense envelope of white fibrous tissue. On section the epididymis appears normal; the testis has a uniform soft, gummy consistency; the wide outer zone is cream yellow, the inner portion tinged dark red. The tubules may be teazed out a very little in places.

Microscopic. In one place epididymal tubules, each surrounded by a wide zone of dense fibrous tissue. The most of the specimen shows at one edge dense fibrous tissue, vessels with much thickening of intima, irregular areas of leucocytes, and a few epithelioid cells, while the remainder and major part consists of a basis of granular, poorly staining (necrotic) material, containing uniformly, but not thickly distributed, small round cells (lymphoid). No unaltered testicular tubules are seen.

S. 99-72 — Anat. Diag. — Tuberculosis of Epididymis and Testis.

Gross. A testis with its coverings, lying in a cavity slightly larger than itself, bathed in a creamy, thick fluid. Without this sac is a mass of dense, tough fibrous tissue 3.5 cm. thick, covering apparently all the testis except the side on the median line. On section this mass is dense white and bluish fibrous tissue, with a central area light brown and less compact (epididymis).

The testis (5 × 3 cm.) on section teazes readily, but in the midst of

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the tubules just above the centre is a mass about 1.5 cm. in diameter irregular, which contains no tubules, is divided off by a soft wall, and is made up of a sticky creamy fluid or semi-solid. This cavity connects by a sinus with the sac in the tunica vaginalis.

Microscopic. Shows broad bands of fibrous connective tissue, some of dense, some of loose net-work, containing free red blood corpuscles and leucocytes. These bands extend round and into large conglomerate masses of tissue made up of firm fibrous tissue, small vessels, many lymphoid cells, and here and there a giant cell, with murally arranged nuclei and with a few scattered epithelioid cells about it. Normal epididymal tubules may be seen; others show involvement in tissue like the above.

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XIII.

BACTERIOLOGICAL REPORT OF ONE HUNDRED CASES OF ACUTE APPENDICITIS.

By H. C. Low, M.D.

In this paper only cases showing the clinical symptoms of an acute appendicitis of less than three weeks' duration have been reported. Except for certain instances, in which the culture swabs were not satisfactorily taken, they represent one hundred consecutive cases examined, bacteriologically, in the Pathological Laboratory of the Boston City Hospital during the last year.

In every case the cultures were made with a sterile cotton swab from the abscess itself, or the point of principal infection. In every case smears from these swabs were examined and cultures were made on Loeffler's blood serum. This serum was prepared according to the methods of Mallory and Wright.[1] Neutral media was generally used, though in many cases media, with an acidity of 0.5 of one per cent., was also used.

In forty-two of the cases cultures were made at the same time in agar plates, and in thirty cases in neutral glucose bouillon also. The agar and bouillon were one per cent. glucose media, made in the usual manner. In many cases more than one swab was taken in order to insure sufficient material for making these several cultures.

The reason for using all these various media in a certain number of cases was to determine which could be depended upon to show the variety of organisms found in the mixed infections of these abscesses.

[1] Mallory & Wright. Pathological Technique, p. 81.

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The usual routine in cases where several cultures were made from one swab was to inoculate, first, a blood serum tube; second, a melted agar tube, from which dilutions were made; thirdly, a bouillon tube, and then another serum tube. In many cases the smears were made on a new slide, sterilized by heat before inoculation of the cultures. The object of making two serum cultures was to be able to determine by the growth in the last one, if the swab had held sufficient material for the inoculation of all these cultures. In these cases the second serum culture showed the same organisms as the first.

The Gram stain, with Bismarck brown as a counter stain, was used as a routine method. Examinations of the water and surface growths of the serum tubes were made at the end of twenty-four and forty-eight hours' growth. The bouillon tubes were examined at the same time. The agar plates were examined with hand lens or low power of the microscope, and from any suspicious colonies smears and plants in blood serum tubes were made. In many cases, in making this examination the media was cut from the bottom of the Petri dish and turned into the cover, so that small colonies at the bottom might be reached. Every attempt was made to prevent any of the pyogenic organisms from being overlooked.

It was not attempted to identify all of the organisms found. The staphylococcus pyogenes aureus could be easily isolated and identified. The diplococcus lanceolatus was only isolated and identified in three instances; in other cases the diagnosis was based on its morphology.

The diagnosis of streptococcus pyogenes was only made in cases where there were present in both smear and culture flattened streptococci in chains of at least ten elements, and a few cases where the smear was negative, and the cultures showed many chains of typical streptococci. In only a few cases were the streptococci isolated and their virulence proved.

The bacillus coli communis whenever found was isolated and identified by its gas production in glucose bouillon in fermentation tubes or glucose agar, by its production of indol

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in glucose free bouillon, by its acidification and coagulation of litmus milk, by its motility in young bouillon cultures, and the characteristic growth on potato and in gelatine stab cultures. The other closely related bacilli were similarly identified as far as possible. The various intestinal saprophytes were ignored.

There were thirty cases in which cultures were made at the same time in blood serum tubes and agar plates, when both the streptococcus pyogenes and bacillus coli communis were present. In every one of these cases the bacillus coli communis grew well in both media, and in the blood serum the streptococcus was present in good typical chains. In only six of these cases were streptococci found in the agar plates. That is, in only twenty per cent. of those cases, in which the blood serum cultures showed the streptococcus pyogenes to be present, was it detected in the agar plates.

This is to a certain extent due to the fact that the streptococcus grows better in slightly acid media, and while neutral agar was used in all cases, blood serum of slight acidity was used in a few cases. It must, however, be largely due to the fact that the streptococcus multiplies much more rapidly in the water of condensation of blood serum than it does in the solid agar media. For while in some cases there was a nearly pure, healthy growth of streptococci in long chains in the serum culture, the agar plates made from that same swab showed no colonies of streptococci.

In smears from the water of condensation chains of streptococci can be very easily detected, but on the surface of the serum the colonies of this organism are not so often found.

In neutral glucose bouillon also there was the same difficulty in finding the streptococcus. Fifteen cases, in which serum cultures showed the presence of streptococci, were planted simultaneously in bouillon. Only thirty-five per cent. of the bouillon cultures showed a growth of streptococci.

Of these one hundred cases nearly fifty per cent. were studied from both serum and agar cultures. The making of agar plate cultures was given up, as it was found that they could not be depended on to show all the organisms present

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in these mixed infections. Blood serum of about 0.3 per cent. acidity to the phenalthalein test was found to be the medium best adapted to the growth of the various organisms found. This medium was used in the rest of the cases. A comparison of the results in these two groups of cases shows the percentages of organisms present to be almost identical.

In the cases here reported the bacteriological findings are shown in this table:

Streptococcus pyogenes (pure culture) . .	2
Streptococcus pyogenes or diplococcus lanceolatus and bacillus coli communis . .	61
Streptococcus pyogenes and intestinal saprophytes	15
Bacillus coli communis (pure culture) . .	8
Bacillus coli communis and unidentified cocci,	13
Bacillus lactis ærogenes and bacillus pyocyaneus	1
	100 cases.

This table is arranged to show the relation between the occurrence of the known pyogenic organisms and the bacilli of the colon group. The diplococcus lanceolatus has been considered with the streptococcus pyogenes as being a pyogenic organism. The staphylococcus pyogenes aureus occurred in six cases, in all of which the streptococcus was present. The paracolon bacillus was isolated in four cases and considered with the bacillus coli communis.

Arranged in a different manner these cases show that the streptococcus pyogenes or diplococcus lanceolatus occurred in seventy-nine per cent. of the cases and that the bacillus coli communis occurred in eighty-one per cent. of the cases. In some of the thirteen cases in which the bacillus coli communis and unidentified cocci were found there were undoubtedly streptococci which did not grow in culture. In several of these cases the smears showed organisms which were very probably streptococci. It is evident the percentage of cases in which the streptococcus is reported is not as high as it should be.

In the cases of under three days' duration the streptococcus pyogenes was present in eighty-one per cent. and the bacillus

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coli communis sixty-two per cent. In the cases of two or three weeks' duration the streptococcus pyogenes was present in fifty-five per cent ; and the bacillus coli communis in eighty-seven per cent. In chronic cases the bacillus coli communis is much more common. It will be seen that the streptococcus pyogenes was present more often in the early cases, and the bacillus coli communis more common in the cases of longer duration. This suggests that the bacillus coli communis is present in appendicitis, as a secondary infection. Those cases in which the bacillus coli communis alone was present are found to be of varying duration from eighteen hours to three weeks. The case of eighteen hours was one of acute periappendicitis with no pus. In the only other case of acute appendicitis, of less than three days, in which the bacillus coli communis was found in pure culture there was an acute suppurative appendix full of pus. In this case the smears showed a moderate number of pus cells and few bacilli. The cultures showed a profuse growth of the bacillus coli communis. This case may have been due to the bacillus coli communis alone.

The presence, however, of the well known pyogenic organisms, the streptococcus pyogenes or diplococcus lanceolatus, in such a great number of cases shows them to be a very important factor. The co-existence of the bacillus coli communis in these abscesses is to be expected in an infection in such close relation to the intestine where it is normally present. Moreover, in the very acute cases the pyogenic organisms were almost always present and the colon bacillus was only found alone in one case of typical acute suppurative appendicitis.

The results of these cases show clearly that the streptococcus and other pyogenic organisms are present in a very large per cent. of acute appendicular abscesses. The bacillus coli communis has been considered by many to be the cause of appendicitis. De Klecki[1] undertook a series of experiments to prove the virulence of the bacillus coli communis. He showed that in a tied-off loop of the rabbit's intestine when a venous stasis was present, the colon bacillus might become

[1] de Klecki, Annales de L'Institut Pasteur, T., ix, N. G.

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increased in virulence. He[1] produced fatal appendicitis in the rabbits by interfering with the blood supply of the appendix, so as to cause a venous stasis, and in these cases he found the colon bacillus always present and sometimes alone. He does not report any of the other organisms found.

Chronic catarrahal enteritis of the large intestine is considered by many as very important in the etiology of appendicitis. Sonnenberg[2] maintains that acute appendicitis only occurs in an organ the wall of which is altered by a chronic pathological process. Fæcal concretions, mechanical obstruction by torsion or catarrahal secretion, and foreign bodies may all be predisposing causes of appendicitis. The presence of pyogenic organisms in such conditions is probably necessary to the formation of a typical appendicular abscess.

Most observations, like those of Kelly,[3] who found the bacillus coli communis in pure culture sixty-nine times in ninety-four cases of acute appendicitis, and the streptococcus present in only one case, have been made with agar or bouillon media. In our cases, however, both agar and boullion media are shown to be unsatisfactory for the growth of the streptococcus. The importance of the streptococcus has been already recognized by many writers on appendicitis. The colon bacillus is looked upon by them as a secondary infection. It is well known that the streptococcus dies out very quickly in cultures. The appendix forms an excellent culture tube, and offers good opportunity for growth. The profuse growth of the intestinal bacilli, however, soon kills off the streptococci.

At least these cases show that the pyogenic organisms are present in acute appendicular abscesses much more often than most observers have reported them, and that they are the principal etiological factor. The value of the Loeffler's blood serum as a routine culture medium is also shown.

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[1] de Klecki. Contribution à la pathogénie de l'Appendicite. Annales de L'Institut Pasteur, T. xiii., N. 6, p. 480.

[2] Sonnenberg, Mittheilungen auf d. Grenzgebeiten d. Med. u. Chir. i., iii.—1898.

[3] Kelly, A. O. J. Philadelphia Med. Jour. Vol 4, p. 1032.

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XIV.

THREE CASES OF ACUTE RETROBULBAR OPTIC NEURITIS PROBABLY RHEUMATIC.

By Walter B. Lancaster, M.D.

Case I. — O. D., rapid failure of V. to total amaurosis accompanied with considerable pain and tenderness, recovery beginning in two weeks and reaching nearly $\frac{6}{12}$. O. S. similar but less severe course beginning six weeks after O. D. V. reduced to perception of light, relapse during convalescence following exposure to cold, final recovery with nearly $\frac{6}{8}$ vision.

Miss G. D., twenty-two, student, was first seen by the writer in April, 1898, for a refractive error. Glasses were ordered giving normal vision. O. D. –1.25 cyl., ax. 180. O. S. –3.50 sph. In July, 1899, patient again visited the Eye Clinic during Dr. Bossidy's service complaining that the sight had rapidly failed during the past three days in the right eye. This was preceded and accompanied by pain in the eye and right side of head and face, which felt numb and big. Later, pain in the eye and head was described by the patient as "intense" (no morphine was taken, however). There was tenderness of the eye and orbit, and pain on moving the eye but no redness or swelling. V. = perception of light. Fundus showed optic neuritis. There was some nausea, but it was probably due to the iodide of potassium which the patient was given, for it ceased when the iodide was omitted and returned when the iodide was resumed, stopping again when the iodide was again omitted. Vision went on failing until there was no perception of light. Within two weeks vision began to improve. Perception returned first on the nasal side of the field.

In September, or the last of August, the left eye began to fail. This eye was not so severely attacked as the right. The pain in the side of the head was much less, and there was less tenderness of the orbit and eyeball. V. became light perception only or doubtful

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hand movements. When V. had improved considerably in this eye there was a relapse following exposure to cold, on a cold Sunday in October, when there was no fire in the house, and the patient became chilled in spite of extra wraps.

The subsequent history was uninterrupted improvement. When last seen, March 14, 1900, the patient with her glasses (O. D. –1.25 cyl., ax. 180. O. S. –3.50 sph.) could read with the right eye, which had been, at the height of the attack, totally blind, nearly all the letters of $\frac{6}{12}$, and with the left eye, which had been reduced to perception of light, she read nearly all of $\frac{6}{8}$.

Previous history: For two months previous to the onset of the neuritis the patient had suffered from pain in her right arm, which she could not raise to her head without the help of her other arm. There was no evidence of syphilis, no history of any acute infectious disease, of lead or other poisoning, no suppression of menstrual or other discharge, no history of injury of orbit or adjacent parts. The patient had not passed through any severe over exertion or been exposed to cold or wet preceding the onset of the neuritis.

The trouble with her arm may have been of a rheumatic nature. In view of this and of the relapse following exposure to cold, and in the absence of other cause, it seems fair to class this as a case of rheumatic neuritis. At all events, we are safe in following Leber's classification. He groups these cases under the section entitled, "Acute Neuritis without discoverable cause or due to rheumatic influences."

Case II. — Rheumatic history, pain and tenderness in eye and orbit following exposure, gradual failure of V., photopsia, optic neuritis, gradual recovery till V. = $\frac{6}{5}$ and $\frac{6}{16}$.

Mrs. F. E. S. says she is thirty-five years old, but looks older. Nine years ago she had "rheumatism" in hands and feet some months. Three or four months ago she was struck over the left orbit with the handle of a rake which flew up when she stepped on its teeth. Three weeks ago she was exposed to cold, sitting on the rocks fishing nearly all night. Soon after this her present illness began with the eyes aching. After this had continued two or three weeks her sight gradually failed the last week in August, beginning in the right eye. The sight was described by the patient as having been quivering and uncertain, and she was sure the lower part of field of vision went first, because she could see the top of a person's head but not the lower part of the face when she looked straight at a person's face. Then O. S. lost sight and V. became only quantitative perception of light in this eye. During this time and subsequently patient says she perceived red flashes of light subjectively. About

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September 11 all pain and soreness had left O. D., the trouble was limited to O. S.

When first seen by me, September 19, the condition was as follows:

O. D. V. = $\frac{6}{8}$, field good. O. S. V. = hand movements outward. Tenderness in upper and in back part of left orbit, pain on moving left eye in all directions. Fundi, O. D. Outline of optic nerve slightly blurred, vessel walls thickened and opaque in places, no swelling, no hemorrhages. O. S. Outline of optic nerve invisible, moderate swelling, no hemorrhages, no retinitis. The subsequent course of the disease showed steady improvement; less pain and tenderness, less pain on moving eye. In ten days V. O. S. = fingers at four feet and field with large object normal. In one month V. O. D. = $\frac{6}{6}$; V. O. S. = $\frac{6}{20}$, no tenderness, half the outline of the optic nerve, O. S. was clear. January 20, 1900, V. O. D. = $\frac{6}{5}$; V. O. S. = $\frac{6}{16}$. Fields for white and color normal. The treatment, in addition to rest of the eyes consisted of moderate doses of sodium salicylate and an occasional saline purge; after the tenderness disappeared gentle massage of eyeball and orbit.

The course followed by this case, together with the history of rheumatism and of exposure preceding the attack, justify classing this as a case of rheumatic neuritis. It is to be noted that in both this case and Case I. the neuritis was not unilateral as is said (Leber and Nettleship) to be usually and characteristically the case.

Case III. — Exposure to cold and wet, two days later pain and tenderness of eyeball and orbit followed by gradual failure of V. beginning as central color scotoma, optic neuritis, subsequent history unknown.

Antonio Bianchi was a boss on the Metropolitan Water Works at Clinton. He was exposed to cold, rain and sleet, driving several hours against the wind in an open vehicle. Two days later there was pain in the left supraorbital region and pain on moving the left eye, especially on rotating outward. Five days later he first noticed that his sight was not so good in that eye.

When first seen on the eleventh day the patient had tenderness of eyeball and orbit, redness and excoriation of forehead and temples from application of blisters, slight swelling of optic nerve, a grayish patch down and inward very near the optic disc, in length equal $\frac{1}{3}$ to the diameter of the optic disc, and in width $\frac{1}{3}$ its length. There was a partial central scotoma for red extending 3° up

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and down and to the blind spot outward. V. O. S. $=\frac{17}{40}$. V. O. D. $=\frac{17}{15}$. Two days later V. had fallen considerably; there was no red perception in any part of the field, the optic neuritis was well marked. The patient was urged to enter the hospital, but refused, nor did he again appear at the clinic. Repeated attempts to learn his subsequent history were fruitless.

As far as it was followed the history of this case was typical of a rheumatic retrobulbar neuritis.

Relation of these cases of retrobulbar neuritis to the toxic amblyopias.

It has been shown by Holden and others that in many of the toxic amblyopias (all those where examination has been made) the lesion is primarily a degeneration of the ganglion cells of the retina, and secondarily a degeneration of the axis cylinders ascending from these in the optic nerve, with interstitial inflammation of the nerve, the inflammatory process being relatively unimportant. The cases, such as those here reported, differ from the toxic amblyopias chiefly in the frequent presence of marked evidences of inflammation (exudation, swelling, pain) and in that the process is not primarily in the retina but in the nerve trunk. The feature which binds them together is the striking symptom of central scotoma due to the papillo-macular group of neurons being the chief seat of the lesion. Another feature, which seems to be common to both, which as far as I know has not been pointed out, is that both may be regarded as due to the action of toxic substances. In one group of cases the toxic substance belongs to the drug class — quinine, methyl alcohol, iodoform, Jamaica ginger, tobacco, felix mas, etc. In another group the toxic substance is probably of bacterial origin — influenza, syphilis, etc. In a third group are the true antointoxications due to faulty metabolism and including diabetes, rheumatism, hemorrhage, exposure to cold and fatigue, and many cases where the etiology is obscure. The action of the toxic agent may be acute or chronic. If it produce degeneration only, we call it toxic amblyopia; if it produce added signs of inflammation, we call it retrobulbar neuritis. In so far as the degeneration in either case goes on to necrosis the loss of function is permanent. *These*

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differences are not fundamental. Ziegler says: "degeneration and inflammation of nerves cannot be separated by any sharp distinction." In the vast majority of cases the incidence falls chiefly on the papillo-macular group of neurons, because these are evidently the most vulnerable. In some cases the incidence is on the ganglion cells of the neurons located in the retina, in others on the nerve fibres, in others, perhaps, on both. The process may be unilateral or bilateral.

It seems to the writer that looked at in this light the retrobulbar diseases of the optic nerve become more homogeneous instead of, as Nettleship puts it, a class where cases are placed which can not be placed elsewhere.

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XV.

THE NEW GYNAECOLOGICAL DEPARTMENT.

By Charles M. Green, M.D.

When the Boston City Hospital was dedicated and opened for patients, in 1864, no special provision was made for the treatment of diseases peculiar to women. The comparatively few gynaecological cases that presented themselves in the early years of the hospital were received in the medical and surgical out-patient clinics, or admitted, according to circumstances, to the medical or surgical wards. In 1873, however, an out-patient department for diseases of women was established by the Trustees of the hospital; and at the annual election of the Staff in 1874 two physicians were appointed to the service. Clinics were held three days a week, in a small room in the out-patient building or Lodge, as it was then called. Each physician served for six months in the year; and each was independent of his colleague, being responsible only to the Trustees through the Visiting Medical Staff. In 1888, the department was left, by a resignation, with only one physician; and the Trustees, thereupon, on the recommendation of the Visiting Staff, made an important change in the administration of this service. It was decided to place the department in the charge of one physician, who should be responsible for the service during the entire year: he was allowed an assistant in the medical work; but the general administration of the department devolved solely upon the physician in charge. Under this plan, uniformity of methods and details was secured; but the full advantage of the change was unobtain-

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able with the inadequate accommodations afforded in the old out-patient building.

In January, 1890, the new out-patient building was opened for use; and the needs of the department for diseases of women were amply provided for. In addition to a large consulting room, two well-equipped examining rooms were provided; and it was thus possible for the physician in charge and his assistant to work together. Continuous service was thus made possible, to the advantage alike of patient and of physician: moreover, enlarged opportunities were afforded for teaching, which is one of the chief functions of hospitals, second only to the care of the sick.

During the first nineteen years of the hospital's work, gynaecological cases requiring operative or house treatment were received in the medical and surgical wards. Major operations were necessarily performed in the surgical services; but the great majority of this class of cases were treated in the medical wards, particularly in Ward S. The Trustees, in their report for the year from February 1, 1892, to January 31, 1893, state that "previous to the present year (1892) there has been no service distinctly devoted to the treatment of diseases of women. Patients admitted to the hospital requiring special treatment were assigned to Ward S, and such patients were taken care of by those of the Visiting Physicians who were especially interested in that class of practice. Incident to the growth of the hospital, the number of such cases had become so large that it was evident that they should receive special treatment in a ward specially assigned for such service. The Trustees, therefore, during the present year have created a Gynaecological Service. Ward S has been set aside for the special reception of such cases."

The administration of this new service was entrusted to two visiting physicians: a year later an assistant visiting physician was appointed; but he was given an independent period of duty, and thus it resulted that each of the three physicians did four months service each year. Unlike the out-patient department, the house service had no head; each physician was practically independent of his colleagues.

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Although the two seniors in the house service were supposed to exercise a supervision over the out-patient department, the relation was merely nominal: the ideal organization was not yet accomplished, although the care of the house gynaecological cases was greatly facilitated by the establishment of the in-door department.

During the ensuing years it came to be recognized that the system under which other departments of the hospital were conducted was far from satisfactory. Particularly in the surgical services it was gradually realized that the advent of new surgeons every four months was not conducive either to the best results to the patients or to the professional interest of the Staff. Although each surgeon, on the approaching close of his service, endeavored to clear his wards as far as possible, his successor found many patients whose convalescence was incomplete and whose cases must be completed on a divided responsibility. Moreover, when the new surgeon took up his service, it required several weeks for him to acquaint himself with his large number of cases; and the amount of work required of him to perform his service conscientiously made serious demands on his time and physical strength. Again, under the system in vogue, the teacher of surgery had available clinical material only during his term of four months, except when the courtesy of his colleagues placed material at his disposal. These and other considerations led to a careful study of improved administrative measures, extending over many months, not only by the surgical staff but by members of other departments of the hospital. As a result of these efforts a new administrative plan for the surgical services was recommended by the Staff, approved by the Trustees, and put into effect in 1897. The details of this new plan, the arguments in favor of its adoption, and the advantages expected to result from its pursuit were ably presented by Dr. Herbert L. Burrell in the volume of Medical and Surgical Reports of the Boston City Hospital for 1898.

But the reasons in favor of the new plan of service for the Surgical Department were equally cogent in favor of a similar plan for the Department for Diseases of Women, —

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gynaecology is applied surgery — and on April 20, 1898, the Trustees, on the recommendation of the Staff, adopted the following rules for the administration of the Gynaecological Service : —

The Gynaecological Service, both house and out-patient, shall have a Senior Visiting Physician, a Junior Visiting Physician, a First Assistant Visiting Physician, a Second Visiting Physician, and a Third Assistant Visiting Physician, for Diseases of Women.

The Senior Visiting Physician for Diseases of Women shall have the general direction of the service during the entire year. He shall be on active duty for a period not exceeding four months. When on duty he shall have the assistance of one or more of the Assistant Visiting Physicians belonging to the service, in case he desires it. He shall take full charge of such cases as he wishes, and may assign such of his work to the Assistant Visiting Physician as he sees fit. He shall also have the right to take entire charge of such cases as he desires, when not on active duty, and for such time as he wishes.

The Junior Visiting Physician for Diseases of Women shall be on active duty at least four months. When on duty he shall have full charge of the wards, being responsible, however, to the Senior Visiting Physician. He shall take full charge of such cases as he wishes, and may assign such of his work to the Assistant Visiting Physicians as he sees fit, having, when on active duty, the same privileges in respect to the services of the Assistant Visiting Physicians as the Senior Visiting Physician enjoys when he is on duty. He shall also have the general direction of the service when the Senior Visiting Physician, from absence, illness, or other reasons, is unable to perform his duty.

The First Assistant Visiting Physician for Diseases of Women shall carry out the direction of his senior in the service, both in the wards and in the out-patient department. His special service shall be in the hospital wards. When on duty he shall have full charge of the wards, being responsible, however, to the Senior Visiting Physician of the service. He shall have the same privileges in respect to the assistance

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of the other Assistant Visiting Physicians in the department, which his seniors have when on duty.

The Second Assistant Visiting Physician for Diseases of Women shall be on duty in the out-patient department during the regular months assigned to him, and during those months, as well as during the rest of the year, his services shall be at the disposal of his seniors, and he shall have charge of the wards during such time as his seniors shall direct.

The Third Assistant Visiting Physician for Diseases of Women shall perform duties essentially the same as the Second Assistant, except that his work shall be more closely identified with the out-patient department. His services shall, however, be at the disposal of his seniors in the service.

When the exigencies of the service require a Fourth Assistant Visiting Physician for Diseases of Women for a limited period, an appointment of such assistant for a term not exceeding six months may be made by the Board of Trustees on nomination of the Senior and Junior Visiting Physicians of the service.

Each Assistant Visiting Physician for Diseases of Women may have a vacation of two months in the year, and shall have a vacation of at least one month in the summer, in addition, if he wishes it.

Thus, after ten years, the administrative principle established in the out-patient department in 1888 was extended also to the house service.

A careful examination of these rules and a study of their application will reveal the following advantages over the old system: —

First, to the patient: Terms of service are so arranged that, as a rule, patients remain under the continuous care of a single physician. Especially is this the fact in surgical cases: the member of the staff that performs the operation conducts the convalescence. An incidental advantage to the physician of this administrative method is the opportunity of completing his own cases, and of not dividing professional responsibility with a colleague: there is also a concomitant advantage to the physician newly on duty, in that he is

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neither called upon to take charge of a large number of cases in the first few weeks of his service, nor must he assume the responsibility of cases in which operation has already been performed, or treatment inaugurated, by another.

Second, to the senior physicians: Through the provision of assistance in their work, they are enabled to assign to others such cases as they see fit, thereby finding time for the study of difficult or unusual cases, and for general administrative duties. They are spared the fatigue of excessive routine work which can be performed as well by an assistant, and are enabled to give to the hospital the benefit of a long experience and a mature judgment when no longer able to perform a large amount of professional work.

Third, to the junior physicians: Through the opportunities offered for work in the house service, as well as in the out-patient department, they are enabled to acquire a broader experience and a greater skill at an earlier period in their lives, when they have more time and strength to devote to hospital work. They have the advantage of association with their seniors, and opportunity to profit by their greater experience and maturer judgment.

Fourth, to medical education: Through the principle of continuous service for the senior, and of long, albeit subordinate, service for the junior, the opportunities for teaching are greatly facilitated. The senior has a choice of material through the entire teaching year. To the junior, with his long service, may be delegated a share in the work, and he thus has an opportunity of training his ability, and of proving his capacity, to teach.

Fifth, to the hospital: Unity of control should ensure improved administration. The senior is able to devote a considerable portion of his time to administrative duties: the general welfare of patients, the fidelity and intelligent service of house officers and nurses, the supervision of records, and the general management of the service should be his constant care.

Ward S, which was assigned to the Gynaecological Service on its establishment in 1892, soon proved insufficient for the work devolving upon it. Numerous cases were denied

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admission for want of beds; there was no etherizing or recovery room, no suitable room for instruments and supplies, and no operating room adequate to the demands of

Sterilizing Room, Ward S.

modern surgery. But in 1898, after the reorganization of the department, the Trustees were enabled to refit this ward in a very satisfactory manner. The southerly end of the main corridor was shut off by glass doors, and the old oper-

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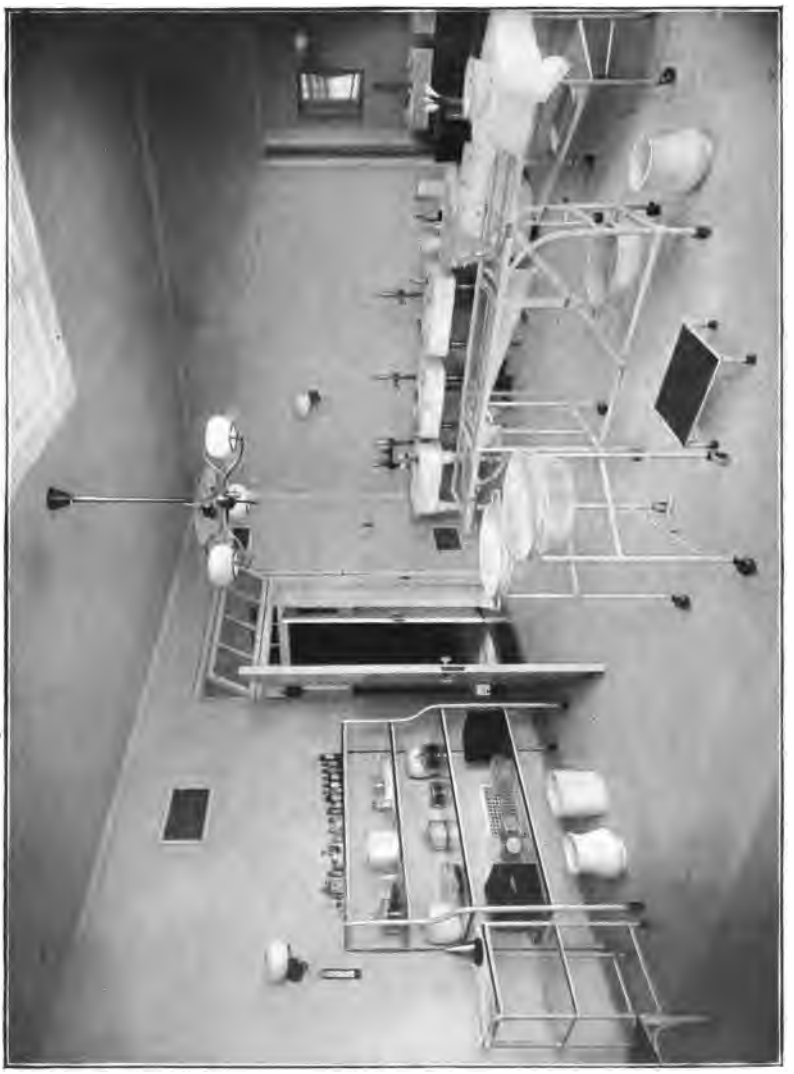
ating room and three adjoining rooms were stripped and refinished for surgical uses, with hard-finished walls, marble bases and ledges, and encaustic tile floors. One room was



Operating Room, Ward S.

fitted as a sterilizing room and for the storage of instruments and supplies; and one, provided with two beds, as an etherizing and recovery room. The operating room was provided with ample side and overhead light; and opening from the

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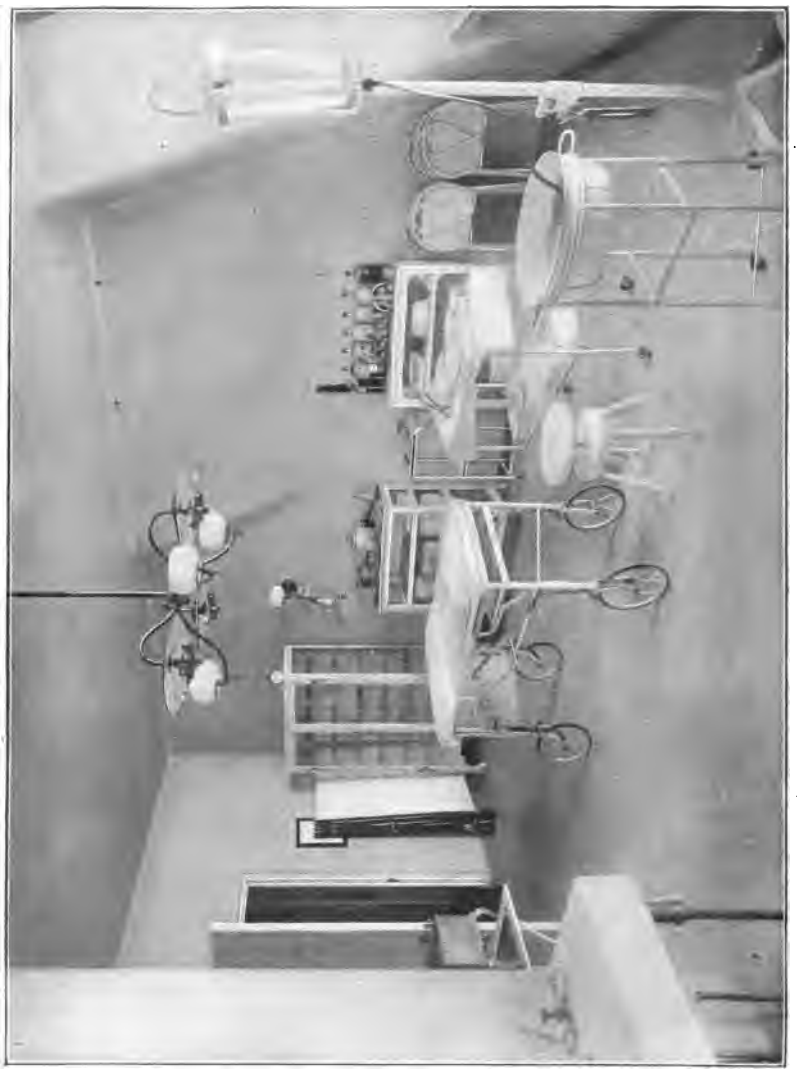
operating room was made a preparation room for the Staff: both of these rooms were furnished with new, open plumbing, porcelain bowls, and treadle faucets. As now arranged



Minor Operating Room, Ward H.

this ward contains twenty-five beds, — fourteen in the open ward, ten in the four rooms, and an emergency bed in a corridor. The operating room is equipped with modern surgical furniture and appliances; and it is in this ward that the major surgical work is done.

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Ward H, which was also assigned to the Gynaecological Service, and which is connected with Ward S by an open-air corridor, has twenty-eight beds in the open ward and two in an isolating room. At the westerly end of the ward, a room has been fitted, like the operating room in Ward S, with hard-finished walls and tile floor, new open plumbing, and modern surgical furniture. This room is well adapted for minor operations, and for the examination and treatment of the less serious cases.

The service is also allowed four or five beds in Ward L, for cases requiring isolation or restraint, and for those whose presence in an open ward would be prejudicial to other cases. The Gynaecological Service thus has in all about sixty beds, — a very suitable proportion to the total capacity of the hospital.

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XVI.

TUBERCULOSIS OF THE HEART.

By Albert Moser, M.D.

Tuberculosis of striated muscle has always been considered exceptional but Sänger (Tuberculose des Herzmuskels, '70) claimed it was more common than Virchow admitted, especially around fistulæ, joint suppurations, œsophagus, tongue, pharynx, and inner larynx. In the above article he reports 1,469 autopsies in Leipzig on tuberculous subjects with four instances of tuberculosis in the endocardium and three in the myocardium. The pericardium was affected five to six times as often.

As to valvular endocarditis of tuberculous origin, Tripier (90) reported a case first diagnosed as typhoid, then as general tuberculosis. The autopsy confirmed the latter view. On the circumference of the mitral valve were small white vegetations, showing a granular centre, small round cells and giant cells. No bacilli were found. His conclusions are remarkable; that this is the first case of a tuberculous nodule in the heart, and that acute tuberculous endocarditis is nearly constant in cases of general miliary tuberculosis. The whole article seems decidedly theoretical, exactly the reverse of recent work by Michaelis & Blum (98) which is purely experimental. These observers perforated the aortic valves in rabbits and produced an easily-heard diastolic murmur. Two hours later tubercle bacilli were injected into the ear vein. The animals died in three to six weeks from a diffuse tuberculosis. The perforated valves were richly covered with tender warty growths up to the size of a lentil, in which bacilli were found singly or in masses. A circumscribed

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typical tubercle was also present. No other bacteria were found. Hence they conclude that the tubercle bacillus alone can cause endocarditis verrucosa. Clinically, such a case should, perhaps, still be considered problematical.

The endocarditis that concerns us most is not valvular, but mural. Thrombi on the heart wall sometimes accompany the large solitary tubercle, which is by far the most common form of heart tuberculosis. Townsend (32) reported the first case, in a man aged sixty-two. There was a large tuberculous mass nearly an inch in thickness in the wall of the left auricle. Death finally resulted from asphyxia, as the mass compressed the pulmonary veins and thus caused dilatation of the veins in the lung tissue.

Von Recklinghausen (59) reported miliary tubercles in the pericardium and about twenty under the endocardium. The latter was on microscopical examination found thinned and more or less destroyed. The areas appeared very much like lymphatic tissue, so called lymphoid tubercles.

The differential diagnosis between gummata and large tubercles was given by Virchow (64), who laid stress on the presence of a general tuberculosis. He thought that many so-called tubercles of the heart were really gummata. With modern methods of diagnosis the difficulty is not so evident. Ziegler (95) says gummatous nodules in the heart are very rare.

The first analysis of the literature was by Haberling, whose inaugural dissertation "De Tuberculosi Myocardii" was published in 1865. He reviews many cases, and accepts twelve, but some of them were of the pericardium only, while others involved all three layers.

The next summary was by Sänger (78) who collected nineteen cases, and added three more, two of which had histological descriptions. This article formed the basis for all future work on heart tuberculosis. Koch's (82) stupendous research on etiology called attention to the necessity of demonstrating the bacillus of tuberculosis. Denny (86) found this useful in a case of primary heart tuberculosis. There were three pea-sized tubercles in the left ventricle, which showed "two to five bacilli in a field." The bron-

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chial and mesenteric lymph nodes were normal. No histology was given. A similar primary case was reported by Mall (92), in which fifteen to twenty giant cells were found in a single field. He suggests as a possible origin a focus in lung, bone, or lymph tissue not found at the autopsy.

Labbe (96) collected thirty-eight cases, giving classification, origin, and extent. Barie (96) and Brosch (96) increased this number to forty. Hond (98) added two more, both of which occured with a general tuberculosis. The histological description of one was brief but satisfactory. Bacilli were sought, but few being found in one case, and all escaping detection in "the other." In another report of the same cases (Prac. Path. Soc. of Phil., Feb. '98) it was stated the "demonstration of bacilli failed through an unfortunate accident." This second case is admitted, as there was a most extensive general tuberculosis and "a small pearly tubercle visible through the endocardium of the left ventricle." But when the microscopic description is so brief, and no bacilli were demonstrated, then certainly the histological description should consist of something more than merely "an aggregation of small round cells."

To these cases are now added three more from the literature, not heretofore included in the summary, and a fourth is reported for the first time, making the present number forty-six in all.

Mariam (89) in a case of mitral insufficiency, loosened some adhesions between the pericardial layers and found a hazelnut-sized cavity in the hypertrophied anterior wall of heart. The cheesy contents contained tubercle bacilli, pus corpuscles, and the microscoccus tetragenus.

Birch-Hirschfeld (91) reported to the Section for Pathology, meeting of German investigators, Halle, a case very similar to the one in this paper. In the right auricle of an old man, with genito-urinary and pulmonary tuberculosis, there was found a tough, fibrous, fleshy adherent body. It was considered a sarcoma till microscopic examination showed it to be a thrombotic mass of leucocytes, organized in places, with areas of fresh tuberculosis. He gives two possible origins: (1) bacilli wandered into a mural thrombus, or (2) bacilli

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clung to heart-wall, grew, and thus formed a thrombus. The latter was believed the more probable, as Ribbert produced endocarditis by injecting into the circulation particles of potato laden with micrococci.

Hoisholt (99) in a case of two years' duration, found tuberculosis of lungs and pleura, caries of ribs, sternum, and adherent pericardium; a large tumor was found in the left ventricular wall, which here measured 3.5 cm. in thickness. A similar mass was found in the upper part of the right auricle. The histological examination showed cheesy areas with zones of round-celled infiltration, in which were giant cells. Beneath the pericardium were a number of smaller miliary areas with cheesy centres.

The collected cases have been analyzed as follows:

Age. — Pollack (92) found fourteen cases from nine months to fourteen years, nine from nineteen to forty, and two at sixty and sixty-five. Adding the cases since then the proportion is about the same. Nearly sixty per cent. are in children under fourteen years of age.

Sex. — This question seems immaterial. Sänger (78) said there was no difference.

Origin. — A general tuberculosis is so commonly present that the few primary cases (Demme, Mariani, Nall) must still be considered *sub judice*. Nall (92) himself suggested a focus in lung, bone, or lymph node not discovered. As a rule the bronchial lymph nodes and lungs are always affected. Genito-urinary tuberculosis is common in older subjects, as in the case to be mentioned later. The mesenteric lymph nodes are often caseous. Reimer (76) gave as origin an abcess in the body of the fourth thoracic vertebra. Pollack (92) found cavities in the vertebræ, extending from the middle of the neck to the sixth thoracic. Hoisholt's (99) case started from a left-sided pleurisy, followed by caries of ribs and sternum. Labbe (96) gave the rule that it succeeds a thoracic lesion when there is no acute miliary process. The lymph passages are much more important as a means of communication than the blood.

Distribution. — Lesions were found twelve times in the right auricle, thirteen times in the right ventricle, eight times

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in the left auricle, and twenty times in the left ventricle. Sänger's figures (78) are about in the same proportion.

Classification. — The most frequent form by far is the large solitary tubercle, from the size of a pea (Reimer, 76) up to nearly the size of a hen's egg (Pollack, 92). The latter said the miliary form was the commonest, a statement also made by Virchow in 1864. A third form, even rarer than the miliary, is a sclerotic myocarditis. Number 21 of Sänger's list was of this kind, as is also the present case. Labbe (96) gives as a distinct form a diffuse tuberculosis. No one else mentions it.

Pericardium. — Nall (92) found both pericardia sound in his case and considered the condition a rarity. A majority of all cases present some adhesions, from a very few to a complete synechia. In two of the last four cases reported the pericardium was normal, in one was not mentioned, and in one was completely fused.

Histology and Bacteriology. — Biondi (95) disputed the occurrence of heart tuberculosis on account of two failings, the classic scheme of the miliary tubercle and the presence of bacilli inside of the vegetations. Birch-Hirschfeld (91) found well-formed tubercles enclosing giant cells. The latter have been mentioned by nearly every reporter, and even if Biondi could not find bacilli in nine cases which he studied their demonstration by half a dozen observers seems decisive. Demme (86) first found them in heart tuberculosis. Mariani (89) reported their occurrence in an early lesion. Birch-Hirschfeld (91) found them in an organizing thrombus similar to the present case. Pollack (92) found a few by the Ziehl-Neelson method and claimed it was the second time, evidently overlooking the preceding two. Labbe (96) found many in sections, "veritable amas." They have been demonstrated several times since.

Symptoms. — As a rule, they are rare. There have been present dyspnœa, palpatation, orthopnea (Townsend, 32); sticking pains in heart region, with signs of adherent pericardium, which was found at autopsy (Reimer, 76); sudden dyspnœa, cyanosis, unconciousness (Demme, 86); sudden

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death (Nos. 11, 92). Among other symptoms reported are tumultuous heart, diffuse pulsation, arythmia, irregular fetal, or galop rythm, precordial pain, general œdema. Brosch's (96) case had enormous numbers of tubercles in the liver, and among other signs had Weil's complex, jaundice, enlarged spleen, and albuminuria.

Diagnosis. — This has never been made. Perhaps the strongest single point is the presence of a general tuberculosis.

The present case, hitherto unreported, entered the Boston City Hospital, January 7, 1898. For the history I am greatly indebted to the Visiting Staff.

J. C. C., fifty-three, single. No tuberculous history. Rheumatic attacks the last two winters. Left testis has been enlarging for some time, painful for last week. A dull pain in lumbar region. On examination, left epididymis and lower half of left testis are involved in a large, moderately dense non-fluctuant swelling, not painful or sensitive. Cord on left side is somewhat swollen. Lymph nodes in both groins somewhat enlarged. In a few days he was unable to micturate. Bladder was distended. A week later he complained of numbness in calf and foot. Some incontinence. Then motion disappeared from right leg and became weak in left. Knee jerks were absent, also sensibility to pin pricks. There began spasmodic jumps in the legs. Pupils reacted normally. Plantar reflex at times active. Abdominal and cremasteric reflexes absent. Pain in abdomen at times great. Patient could not rise to sitting posture. Motion of upper extremities good. Two days later voluntary motion of left leg lost. No sensation below anterior iliac spines. Sores developed on heels. Strength gradually diminished, and death occurred three weeks after entrance.

AUTOPSY REPORT IN BRIEF.

Decubitus over sacrum and heels.

Pleural adhesions over right lung and at apex of left. Pericardium normal, containing 40 cc. of clear serum. Heart weighs, 340 grms. At apex of left ventricular cavity is a firm yellow thrombus, 2 cm. in diameter, adherent to

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myocardium. The papillary muscle and myocardium are yellow and fibrous on section. There is some fat found on making a fresh section of the myocardium. Aorta shows thickened yellow areas and one patch of calcification. In apex of right lung is a cavity 4 cm. in diameter, with ragged walls. The surrounding lung tissue is solidified with some caseation. In the middle and lower lobes are solid areas, 2 to 3 cm. in size. There is œdema in the lower lobe. In the left lung are scattered areas of solidification of small size.

Liver weighs 1,900 grammes and shows scattered miliary tubercles. Kidneys together weigh 335 grammes, and show small miliary foci beneath the capsule. No fat found in fresh section.

Bladder and right testicle normal. Left testicle has epididymis much enlarged. Epididymis on section is yellow, firm, with caseous centre. Testis is apparently normal. Vas deferens of left side is thick and firm. Approaching the seminal vesicle the vas is enlarged to the size of a lead pencil and markedly hardened. Seminal vesicle on left side is enlarged, thickened and caseous. Prostate enlarged and firm.

Spinal cord from ninth to twelfth dorsal segments soft and disintegrating. Vessels are injected; on section markings lost; appears grayish white with purplish tinge. Brain normal. Cerebellum shows in right inferior peduncle a yellowish gray round area the size of a large pea, with a red halo. In the right lateral hemisphere is a similar area.

ANATOMICAL DIAGNOSIS.

Acute softening of cord.

Tuberculosis of cerebellum.

Tuberculosis of lung.

Thrombosis and fibrous myocarditis of left ventricle, with fatty degeneration of myocardium.

Chronic tuberculosis of epididymis, testicle, seminal vesicle and spermatic cord.

Tuberculosis of spleen and kidney.

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HISTOLOGICAL.

Sections were cut through different parts of the thrombus and adjoining heart wall, and stained with eosin and methylene blue, Weigert's fibrin stain, and Mallory's connective tissue stain. The sections showed that the process evidently began with the formation of subendocardial tubercles, which had fused together. An abundance of fibrous tissue had developed on the side towards the pericardial surface. The endocardium was replaced by a rather thick layer of fibrous tissue, on which rested a thrombus. Fibrous tissue and blood vessels were growing into the thrombus; in other words, organization of the thrombus was taking place.

The small tuberculous foci lying along the ventricular surface show no areas of distinct caseation. Giant cells are always present, from ten to fifty in a section. A single field under an immersion lens touches three. In one of these cells are eight leucocytes. Around these giant cells are many nuclei, mostly of lymphoid and plasma cells.

The wavy fibrous septa running toward the pericardium grow smaller as they approach it. They contain few nuclei, but a noticeable perivascular infiltration with lymphoid and plasma cells. Mast cells are sometimes rather frequent. The muscle fibres are often atrophied, rarely vacuolated. Some of the fibrous bands contain a golden yellow pigment in clumps and masses up to the size of several leucocytes. The latter are uniformly rare in all sections.

The growth of fibrous tissue into the thrombus is most marked at the centre, but in some sections can be traced along the entire border. Undissolved fibrin is still enclosed in the meshes. Around these fibres are many plasma and small round cells. In one section a giant cell is present in the edge of this organizing tissue, and in another section two are lying near each other.

BACTERIOLOGY.

Over twenty sections were cut from five different blocks of tissue and stained for tubercle bacilli, with positive results in nearly half of them.

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The Ziehl-Neelson method did not yield as good results as one given by Mallory and Wright. Stain lightly in alum hematoxylin, then in steaming carbol-fuchsin two to three minutes, decolorize in one per cent. acid alcohol one-half minute, wash thoroughly in water, dehydrate in alcohol, clear in xylol and mount.

The bacilli are present almost universally inside of giant cells, or in their immediate vicinity. Two were found in the border of the organizing thrombus. Rarely half-a-dozen were found in a single section, all of which were cut about seven mikrons in thickness.

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XVII.

HEART FAILURE IN DIPHTHERIA.

By John Jenks Thomas, A.M., M.D., Boston, Mass., *Assistant in Nervous Diseases, Boston City Hospital*, and Cleon Melville Hibbard, A.M., M.D., St. Louis, Mo., *Late Assistant Resident Physician South Department, Boston City Hospital.*

Heart failure, or cardiac paralysis in the course of diphtheria, or during convalescence, has been the subject of much discussion. The object of this paper is to present a study, from both the clinical and the pathological side of a number of such cases. These cases were observed at the South Department of the Boston City Hospital, and in all of them the diagnosis of diphtheria was made from cultures of the Klebs-Loeffler bacillus made during life, and also at the autopsies.

It is unnecessary to recapitulate here the discussions of the changes in the nervous system in diphtheria. It is sufficient to say that acute degenerations occur, most marked in the peripheral nerves, and that the pneumogastric nerve does not escape this change. Some writers have argued that changes involving a part of the fibres of this nerve cannot produce the grave and usually sudden symptoms seen in heart failure, and ascribe these to changes in the heart muscle, or to the thrombi that are occasionally found.

The affections of the heart muscle in diphtheria have been described by Oertel, Mosler, Leyden, Birch-Hirschfeld and

Note. — This paper, written two years ago in connection with Dr. Hibbard, represents some of his last work done while at the Boston City Hospital; it was completed after his removal to St. Louis. Considering his untimely death, greatly regretted by all who knew him, and especially by his former associates at this hospital, it seemed that no more fitting place for the publication of this paper could be found than the Medical and Surgical Reports of the Hospital where some of his best and most important work was done.

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others, and more recently by Rosenbach, and by Dr. Councilman, and we also found changes in our cases.

The cases were as follows:

Case I. — Boy, eight years old. Admitted September 1, 1895, with septic diphtheria of throat, of three days' duration. Heart, systolic murmur at apex on admission. Pulse varied from 90 to 120. Spots of ecchymosis appeared on the fifth day. On the twelfth day note says "voice weak," probably due to paralysis. On the fifteenth day began to vomit, and complained of pain in the epigastrium; pulse weak, he became pale, cyanotic and finally pulseless. Respiration, 70. Died in collapse five hours after the onset of symptoms. The urine on the fourth day contained a large trace of albumin.

Post-mortem examination. — Heart, enlarged and cavities dilated, especially right auricle which was filled with dark clotted blood. Weight, 180 grammes. In the left ventricle there were several round, organized, pea-sized or smaller, thrombi surrounding chordæ tendineæ. The cusps of the aortic valve were thickened and somewhat retracted, and along the line of closure there were a number of pinpoint grayish vegetations. Left ventricle was 1 cm. thick; right, 5 cm. There was some fluid in the abdominal and pleural cavities, and also an increased amount in the pericardium. There was also a chronic passive congestion of lungs, liver, kidney and spleen, and acute lymphatic hyperplasia.

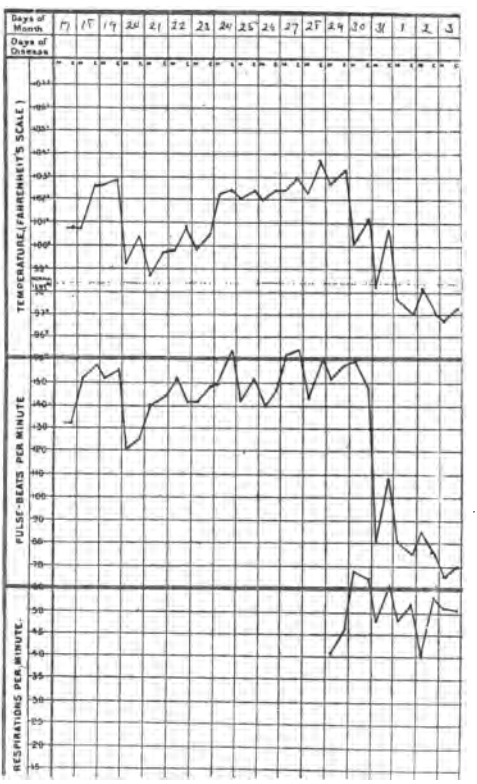
Days of Month
17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 1 2 3
Days of Disease
TEMPERATURE (FAHRENHEIT'S SCALE)
PULSE-BEATS PER MINUTE
RESPIRATIONS PER MINUTE.

Chart I.

Microsopical Examination. — Pneumogastric nerve: Sections showed a most intense and extensive degeneration of nerve fibres. It was impossible to find a fibre which was not affected in most of its course. The amount of fat in the nerve sheaths and axis cylinders was large. Many nerve fibres were represented by a chain of larger and smaller fat drops, with here and there a grayish outline of the fibre visible.

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In places the axis cylinder could be made out, but when present it was swollen and beaded or broken, and in many fibres no axis cylinder could be made out, but only the beaded, irregular fibre, containing many fat drops, could be seen.

Case II. — Girl, aged two years. Admitted August 17, 1896, with septic diphtheria of nose and throat. On the second day vomited once. Spots of ecchymosis appeared on the body which persisted to the end. On the fifth day both ears began to discharge. During the first ten days the child seemed to improve in general condition. The pulse on admission was regular, and the rate varied from 130 to 160, but was usually about 150 (see chart No. 1). On the fifteenth day the rate fell from 140 to 80, and in the next three days to 65. On the eighteenth day had a convulsion, followed within an hour by clonic spasms, which continued for half an hour, when death ensued. The examination of the urine for albumin on the first day was negative.

Post-mortem examination. — Pericardium contained about 40 cc. watery fluid in which a few white flakes were floating. Heart weighed 40 grammes. Valves and cavities normal. The other abnormal conditions found were : general lymphatic hyperplasia and acute splenitis.

Microscopical Examination. — Pneumogastric nerve. Many fibres were seen which were grayish in color, granular and swollen, with swollen and beaded axis cylinder. In a few of these fibres there were fat drops. About half of the fibres seem affected.

Case III. — Boy, aged six years. Admitted August 29, 1896, with a severe septic diphtheria of throat and nose of six days' duration. The throat was clear of membrane in six days. Pulse rate for the first five days was 70 to 80, then it gradually rose to 120 on the nineteenth day, the strength usually poor. Began to vomit on the nineteenth day, and from then on, retained little of the food given by the mouth. Complained also of pain in the epigastrium. On the twentieth day suddenly became pulseless, and died within a few minutes. The urine contained one-eighth of one per cent. of albumin on admission, which later diminished to a trace. No note of paralysis.

Post-mortem Examination. — Heart enlarged. The cardiac area was considerably increased, especially to the left. Weight, 135 grammes. Left ventricle dilated. Mitral valve apparently insufficient. The foramen ovale open to 0.5 cm. in diameter. There was besides ascites, about 750 cc. of clear serous fluid being found in the abdomen. Also serous fluid in the pleural cavity. A chronic passive congestion of the liver and kidneys was also present.

Microscopical Examination. — Pneumogastric nerve. Cross-section. Few fibres showed replacement of axis cylinder or myelin sheath by fat. Almost all showed a brownish discoloration, and in many myelin sheaths the grayish ring was irregular and of varying thickness. Some fibres were much swollen. The axis cylinders had lost their refractive appearance, and some had entirely disappeared. Longitudinal sections. There were a few fat globules in the nerve sheaths and inside them. The sheaths were stained grayish, and were very irregular, striated and granular in appearance. The axis cylinder, when present, was grayish in color and much beaded. Many of them were broken into short masses, some normal in color, others stained gray. In many cases the

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axis cylinder could not be made out. Heart. The muscle fibres of the heart had lost in part their striations, though in most of them longitudinal striations could be seen. Some of the fibres had a homogeneous appearance. Very rarely fibres were seen containing fat drops, and occasionally one containing a vacuole. Many of the small blood vessels were dilated and filled with blood, and there were occasional hemorrhages into the connective tissue about the blood vessels. Here and there throughout the connective tissue, sometimes in the neighborhood of a blood vessel, there were infiltrations of small, round, lymphoid cells, with round deeply staining nuclei and little protoplasm. There were also occasional larger cells, with less deeply staining, granular nuclei and more protoplasm.

Case IV. — Boy, seven months old, was taken ill December 6, 1897, with what the attending physician called at first tonsillitis. Baby was bottle-fed, and on the fifth day of sickness seemed to have great difficulty in swallowing, some of the milk coming out of the nose. On the seventh day had a sudden collapse and was sent at once to the hospital, where it died within two hours.

Post-mortem Examination. — Heart weight, 45 grammes. Slight fatty degeneration of the myocardium. Firm white thrombus in right auricle, slightly adherent. Foramen ovale, 1 cm. in diameter, completely patent. Anatomical diagnosis: Diphtheritic rhinitis, epiglotiditis, tonsillitis, and pharyngitis. Acute general lymphatic hyperplasia, edema of brain, slight fatty degeneration of heart and kidneys.

Microscopical Examination. — Sections of the pneumogastric nerve show most of the fibres swollen, beaded in outline, and grayish in color. No fat is to be seen in the nerve.

Cord. Sections stained by Marchi's method show degenerative changes of the fibres of the anterior and of the posterior roots. There is a diffuse degeneration of the fibres throughout the white matter of the cord, which is most marked, however, in the posterior columns, but is present in all parts of the white matter. The ganglion cells of the anterior horns, stained by Nissl's method, are in general normal. In a considerable number of them, however, the nuclear membrane cannot be made out, and the nucleolus is vacuolated, and occasionally the nucleus takes a diffuse blue stain. The protoplasmic granules are, in general, sharp in outline, but at the periphery of the cell they appear smaller than normal, and in some cells there is a clear space at the border. Sections of the medulla at about the level of the nucleus of the tenth nerve: Nissl's stain. The nuclear membrane of the nerve cells cannot be made out and the nucleus stains blue. The granules of the cell body appear rather smaller than normal. Sections stained by Marchi's method show a diffuse degeneration, less marked in the pyramidal tracts, but well marked throughout the formatio-reticularis, in the internal arcuate fibres, and in the fibres of the hypoglossal and eighth nerves.

Case V. — Boy, aged three years. Admitted March 31, 1897, after an illness of five days, with laryngeal diphtheria. He was intubed on entrance. The tube was removed twice, but had to be re-introduced at once. On the eleventh day in the hospital, coughed the tube up and was dead in less than a minute. No note of any paralysis.

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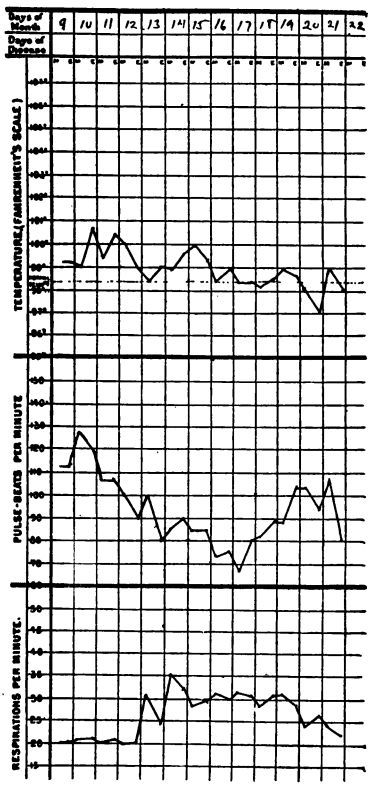
Post-mortem Examination. — Was practically negative save for slight hyperplasia of the lymph glands. Heart weight, 65 grammes, normal.

Microscopical Examination. — Pneumogastric nerve. Sections showed marked degenerative changes of most of the nerve fibres. The nerve sheaths were grayish in color, granular and swollen, and showed the presence of considerable fat. The axis cylinder was often absent, and when present was usually beaded or broken, and replaced by fat drops.

Case VI. — Girl, aged eleven years. Admitted December 9, 1897, with a severe attack of nasal and faucial diphtheria of four days' duration. The membrane gradually disappeared. The rate of the pulse (see chart No. 2) fell slowly from 120 to 70 on the thirteenth day of illness. There was a slight nasal voice from the first; this increased, and within three days there was nasal regurgitation, and two days later complete paralysis of the palate. On account of the paralysis the heart was examined several times a day, and on the tenth day the pulmonic second sound was accentuated. The heart's area of dulness extended to one centimetre of nipple line, pulse weak and thready; vomited some that day. The vomiting from this time persisted. Fifteenth day, a reduplication of the second sound all over precordia; complained of a sharp pain in the epigastrium. This continued more or less to the end. Very pale. The next day cardiac dulness extended from centimetre to the right of sternum, to one and a half outside of nipple line. No murmurs. Patellar reflexes diminished. On the seventeenth day a marked cantering rhythm of the heart sound heard. Heart dulness was then from two centimetres to right of sternum, and three to left of nipple line. Pulse very weak. She went into a collapsed condition and died within four hours. Had a large trace of albumin on the seventh day.


Days of Month
9 10 11 12 13 14 15 16 17 18 19 20 21 22
Days of Disease
TEMPERATURE (FAHRENHEIT'S SCALE)
PULSE-BEATS PER MINUTE
RESPIRATIONS PER MINUTE.
Chart 2.

Post-mortem Examination. — Heart weight, 160 grammes. Both ventricles much dilated, but especially the left. The left ventricle was nine millimetres thick near the base, five near the apex, and three in central part. The valves normal. Circumference of aortic valve was 5.5 cm.; pulmonic, 5 cm.; tricuspid, 9 cm.; and mitral, 8 cm. Abdominal cavity contained about 300 cc. clear serous fluid. The other

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anatomical findings: Acute general lymphatic hyperplasia, tubercular mesenteric adenitis, slight edema of brain. Slight fatty degeneration of kidneys.

Microscopical Examination. — Pneumogastric nerve. There is a very marked degeneration, fully three-quarters of the fibres showing changes. They are brownish in color and markedly granular, and there are many fat drops. The axis cylinders are swollen and irregular, and in many fibres cannot be made out, or are replaced by fat drops. Almost no fibres can be seen which appear normal for any distance. In the cross sections of the nerve, in addition to the degenerative changes, there is noticeably a marked variation in the size of the fibres.

Cord. There is marked degeneration in both the anterior and posterior roots. Rather more marked in the posterior roots. Many fibres for a long distance show no signs of axis cylinder or sheath, but only fat: There is a diffuse degeneration throughout the whole of the white matter of the cord, more marked in the posterior columns, and very marked in the posterior root zone. The fibres in the gray matter also show fatty changes. The sections stained by Nissl's stain, show in the cells of the column of Clark frequent dislocation of the nucleus, and disappearance of granules about the nucleus, and indistinct nuclear membrane. In the cells of the anterior horn the granules are mostly normal. In about half of these cells the nuclear membrane cannot be seen, the nucleus stains, and the nucleolus is vacuolated and appears larger than normal. The blood-vessels of the cord are filled with corpuscles, and occasionally scattered corpuscles are seen outside the vessel wall, near the blood-vessels.

Sections of the medulla show a diffuse degeneration of the nerve fibres, most marked in the fibres of the hypoglossal and vagus nerves, the external arcuate fibres, the pyramids and the fillet. In the nerve cells the granules generally appear normal, but in some cells they are smaller and more numerous, and larger ones are seen at the periphery of the cell. As a rule the nuclei of the cells take a diffuse blue stain, and the nuclear membrane cannot be seen; the nucleolus is larger than normal, and vacuolated. Occasionally a cell is seen with dislocated nucleus.

Heart Muscle. Sections stained with alkaline methylene blue and eosin. The muscle fibres in places appear fairly normal, but in most of them the striations are much less distinct than normally, and in places the fibres are homogeneous, with no striation, and are markedly vacuolated. The nuclei are irregular in shape, sometimes stain darker than normal, and in others, fibres are very indistinct. The heart muscle shows signs of general edema of the interstitial tissue, the muscle elements being shoved apart. In many places in the interstitial tissue there are collections of cells. These cells vary in character. Eosinophile cells are numerous. Many of the cells are rather large, with large, oval vesicular nuclei, surrounded by a small ring of clear protoplasm. Rarely leucocytes are seen, with irregular nucleus and pinkish protoplasm. Also lymphoid cells are occasionally seen, small, with deeply staining granular nuclei. A few mast cells, with large, granular cell body, are to be found. Among these cells are fairly numerous plasma cells, with large vesicular nuclei, and protoplasm taking a bluish tinge.

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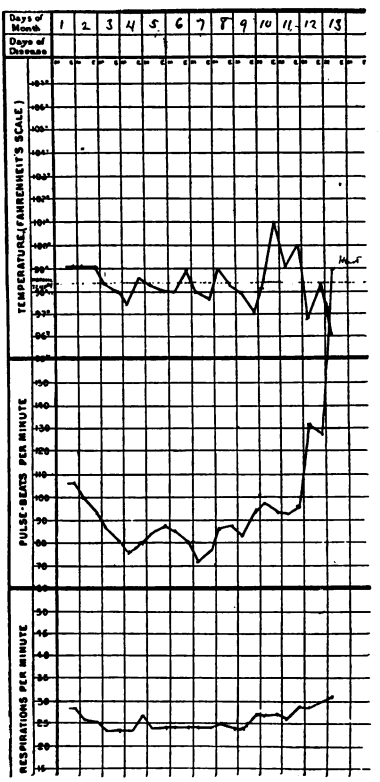
Throughout these areas are numerous capillary blood-vessels with delicate walls, surrounded by dilated lymph spaces, and occasionally very small, evidently degenerated muscle fibres, granular in appearance.

Case VII. — Boy, eight years old. Admitted June 1, 1897, with slight diphtheritic pharyngitis and some laryngeal symptoms of eight days' duration. On admission heart sounds and areas normal. Pulse regular, varied for ten days between 70 and 100 (see chart No. 3). Five days later he was noticed to be quite dull. His color was pale. Heart sounds weak. Urine contained one-eighth of one per cent. albumin. On the ninth day in the hospital there was a suggestion of a systolic murmur at the apex. He had a marked nasal voice. Two days later a faint murmur was heard. The first and second sound at the apex was of the same length. Occasionally there was a reduplication of the first or second sound. The action was irregular. The next day the radial pulse could not be felt. Heart rate, 134. He vomited some. Patellar reflexes diminished. Extremities cold. Lips cyanotic. The following day, two hours, heart-rate was 200, and during inspiration would stop for three or four beats. A *bruit de galop* was heard over the whole precordia. He died in collapse.


Days of Month
Days of Disease
1 2 3 4 5 6 7 8 9 10 11 12 13
TEMPERATURE (FAHRENHEIT'S SCALE)
PULSE-BEATS PER MINUTE
RESPIRATIONS PER MINUTE
Chart 3.

Post-mortem Examination. — Heart enlarged, weight, 155 grms. Length from base to apex 13 centimetres; transverse diameter, 10.5. All cavities distended with blood. In the auricular appendages there were delicate mottled grayish white clots. Tricuspid valve would almost admit the tips of four fingers, and the mitral three. The left ventricle greatly dilated, walls averaging eight millimetres in thickness; valve curtain normal. There was also atelectasis of left lung and sub-pleural ecchymoses.

Microscopical Examination. — Pneumogastric nerve; sections showed a diffuse degeneration of the nerve fibres of moderate intensity. The myelin sheaths were stained gray in color, and were much swollen, while many were broken, but few showed any granular appearance. In many instances the axis cylinder could not be made out, but in others it was swollen and beaded. Fat globules were rare.

Spinal cord. The membranes of the cord were normal. The nerve roots, anterior and posterior, showed extensive degeneration. In the

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white matter of the cord there was a moderate diffuse degeneration of nerve fibres. This was somewhat more extensive in the posterior columns. In the gray matter of the cord the blood-vessels appeared dilated, but no hemorrhages were found there or in any other part of the cord. The nerve cells of the anterior horn showed practically no changes. Occasionally a cell was seen which appeared shrunken or where the nucleolus stained poorly, and was irregular in outline. The nerve cells of the medulla appeared normal. There was a marked diffuse degeneration of the superior cerebellar peduncle, and of the fifth nerve, and slight of the formatio-reticularis.

Case VIII. — Boy, aged five years. Had measles and scarlatina. Admitted July 17, 1897, after an illness of two days, with a moderately severe attack of diphtheria. On the fourteenth day the pulse was 130, irregular and weak. Cardiac dulness extended one and a half centimetres outside nipple line, and four centimetres to right of median line. There was a *bruit de galop* heard all over the precordia, loudest at apex. The first sound over the pulmonic area was sharp and valvular. Vomited twice during the day. Next day had a partial collapse. Heart dulness enlarged one centimetre to both right and left; the apex beat in sixth space. A systolic murmur heard at apex. Pulse weak, irregular, and intermittent. No note of any paralysis. Died on the seventeenth day.

Post-mortem Examination. — Heart enlarged; weight, 120 grms. All cavities much dilated and filled with post-mortem clots. Auriculo-ventricular valves, especially the mitral valve, were dilated. Heart muscle yellowish and opaque. Congestion of lungs, liver, spleen, and kidneys. Slight ascites. Considerable brownish serous fluid in right chest.

Microscopical Examination. — Pneumogastric nerve; in this case there was marked and extensive degeneration. The sections showed a large proportion of the nerve fibres affected to a greater or less extent. Most of the fibres were swollen and grayish, and in many of these there were present considerable amounts of fat, both in the nerve sheath and in the axis cylinder. The axis cylinders were absent in most of the fibres most affected, and were irregularly swollen in the other fibres. Sections from the floor of the fourth ventricle showed the presence of fat in the nerve sheath, and in some instances replacing the axis cylinder in a considerable number of the nerve fibres seen.

Case IX. — Boy, aged six years. Admitted August 14, 1897. Ill for one day with nasal and faucial diphtheria. He was quite septic and continued so, and in two days had many ecchymoses on skin. Throat cleared up slowly. Pulse varied between 130 and 80. On the eleventh day in hospital, heart dulness from one centimetre to right of sternum, to two and five-tenths centimetres to left of nipple line. There was a soft systolic murmur at the apex. Sounds weak and irregular. He vomited several times. Patellar and superficial reflexes diminished. There was almost complete paralysis of the palate. On the following day heart dulness had increased one and five-tenths centimetres to right and left; pulmonic second was accentuated. Pulse could just be felt, and he died suddenly on the next day, the sixteenth day of the disease.

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Post-mortem Examination. — Body one hundred and twelve centimetres long. Heart slightly enlarged; weight ninety grammes. Muscle pale, with minute whitish specks distinctly seen on endocardium. Valves normal. There was also a diphtheritic rhinitis, tonsillitis, pharyngitis, and an acute general lymphatic hyperplasia. Fatty degeneration of heart muscle.

Microscopical Examination. — Pneumogastric nerve; sections showed extensive degenerative process, hardly a single nerve fibre being free from changes. The myelin sheaths were granular and irregular, and all through the specimen there were many fat drops, chiefly small, and in the nerve sheaths. In some fibres the axis cylinders could not be made out, and in most fibres they were irregular and beaded. Sections of the spinal cord showed an extensive degeneration of the fibres of the anterior nerve roots, with a moderate amount of fat. Throughout the cord there was a moderate amount of degeneration of the fibres of the white substance, slightly more marked in the posterior columns. The blood-vessels were widely dilated at various places. The central canal was very much dilated, and a few red blood corpuscles were seen within it. The cells of the gray matter and the fibres of this part of the cord appeared normal.

Sections of heart muscle, stained by Marchi's method, showed a most extensive and intense fatty degeneration of the muscle fibres. Many of the fibres contained larger and smaller drops. The fibres containing fat appeared swollen, as did many of the others. Most of the fibres had lost their striations and appeared homogeneous or granular. Here and there throughout the tissue there were areas of infiltration with round lymphoid cells, which had large, deeply staining nuclei and little protoplasm. These areas were in the interstitial tissue and about the blood-vessels.

Case X. — Girl, aged two and one-half years. Admitted June 21, 1897, with septic nasal and faucial diphtheria, with considerable prostration; sick three days. There were several ecchymoses on body. Pulse varied from 100 to 120, and gradually became weak. Circulation poor; lips cyanotic; extremities cold. Failed gradually from the first, and rapidly during the last two days. Died in a collapse on the ninth day of sickness.

Post-mortem Examination. — Heart enlarged, weight, seventy-five grammes. In the left ventricle, almost at apex, a yellowish, opaque, firm, rough thrombus, one and one-half centimetres in diameter, attached by a small pedicle, two centimetres from apex, to the intraventricular septum. Besides this old clot there were considerable elastic, transparent, pale, post-mortem clots. On section, the thrombus appeared to be of a uniform consistency. Valves normal. Anatomical diagnosis: ulceration of tonsil; diphtheritic rhinitis.

Microscopical Examination. — Medulla. Sections at the level of the pyramidal crossing showed a moderate amount of degeneration, with the presence of considerable fat in the pyramidal fibres. The degenerative process had also affected the fibres of the posterior tracts, but to a rather less extent. The nerve cells were normal. Sections from the cortex of the brain showed the presence of an occasional fat drop in a few fibres. Sections of the pneumogastric nerve showed a slight but

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rather extensive degeneration. A considerable number of fibres showed swollen and granular myelin sheaths, stained grayish in color, and the presence of a small amount of fat. The axis cylinders were many of them swollen and beaded.

Heart. There were numerous clots adherent to the myocardium. This is infiltrated with cells. Many of the fibres appear entirely destroyed. They are paler and infiltrated with vacuoles, which may have been fat. The infiltrating cells are in large part plasma cells, but eosinophile cells are also seen, and a few leucocytes and epitheloid cells. In some of the fibres the nuclei are enlarged. Some fibres cut longitudinally show a condition somewhat resembling Zenker's degeneration in the muscles. The muscular substance is fragmented, and stained brightly with eosin. In other fibres the fibrillæ are separated from one another longitudinally. The blood-vessels are dilated. All parts of the muscle are affected, but the lesions are more marked just beneath the surface of the myocardium.

Case XI. — Boy, aged six years, admitted May 29, 1897, with pharyngeal and nasal diphtheria of two days' duration. During the first fortnight the throat cleared up. On admission the heart was normal; a loud systolic murmur was heard at apex. Pulse varied between 120 and 70. The urine had a trace of one-eighth of one per cent. albumin. There was paralysis of the palate. On the thirteenth day in the hospital the heart dulness had extended from one centimetre to the right of sternum to one centimetre to the left of mammary line. Pulmonic second sound was accentuated. The second sound at the apex was reduplicated every ten to twelve beats. For a time the murmur disappeared. On the forty-first day the heart's dulness was extended to two centimetres outside of nipple line. There was a soft systolic murmur at the apex; the reduplication was more constant. Died on forty-third day of his illness, having failed slowly during the last two days.

Post-mortem Examination. — Edema, congestion, and some atelectasis of lungs. Heart slightly enlarged, weight, 115 grammes. Some hypertrophy possible of left side. Anatomical diagnosis: edema of lungs; otitis media.

Microscopical Examination. — Pneumogastric nerve; section showed very slight degenerative process. A few fibres much swollen, irregular in outline, beaded and stained grayish. The axis cylinders of these fibres were irregular and beaded. Rarely a few fat drops could be seen in the myelin sheath.

Case XII. — Boy, aged six and one-half years. Had measles, scarlatina, diphtheria, and pertussis. Admitted June 10, 1897, with septic diphtheria of nose and throat, and was in a prostrated condition. He began to vomit on the third day, and later would retain nothing by mouth. Urine contained one-tenth of one per cent. of albumin. There was regurgitation of fluids through the nose. Heart action regular; no murmur was ever heard; pulse was weak. During the last two days he was semi-conscious, and died on the eleventh day of his sickness.

Post-mortem Examination. — Heart slightly enlarged; weight, 105 grms. Left ventricle slightly dilated; mitral valve readily admitted two fingers beyond the first joint. Wall from 0.5 to 1.2 centimetres thick. Other valves normal. The rest of the examination showed a

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diphtheritic rhinitis, œsophagitis, and tonsillitis, chronic fibrinous pleuritis, slight emphysema of the lungs, acute congestion of the liver, tuberculosis of cervical and mesenteric lymph glands, and acute general lymphatic hyperplasia.

Microscopical Examination. — Pneumogastric nerve; sections showed a moderately extensive degeneration. A majority of the nerve fibres had swollen and broken myelin sheaths with a considerable amount of fat present. The axis cylinders had often disappeared, and in other cases were irregular and beaded in outline, and broken by fat drops.

Case XIII. — Girl, aged seven years. Admitted December 6, 1897, with faucial diphtheria of one day's duration. On the eighth day of her illness the pulse rate, which had been between 90 and 140, fell to 50 (see chart No. 4), and was of poor strength but regular in rhythm. Area of heart dulness extended from right sternal border to 2 cm. to left of nipple line. Pulmonic second sound sharply accentuated. No murmurs. Complete paralysis of the levator of the palate with marked nasal voice. Color very pale. Vomited twice during the day, and from the following day the emesis became persistent, and continued to the end. Eleventh day: A *bruit de galop* heard in the morning indistinctly, but in the afternoon it was very marked. Heart's dulness slightly increased; action irregular. Pulse rate increasing. Patellar reflexes normal. Patient is very restless. Thirteenth day: Heart dulness, 3.5 cm. to left of nipple line. Pulse very irregular and intermittent, at times so weak that it could not be counted. Became unconscious in the night and died within an hour. The maximum amount of albumin in urine was a slight trace.

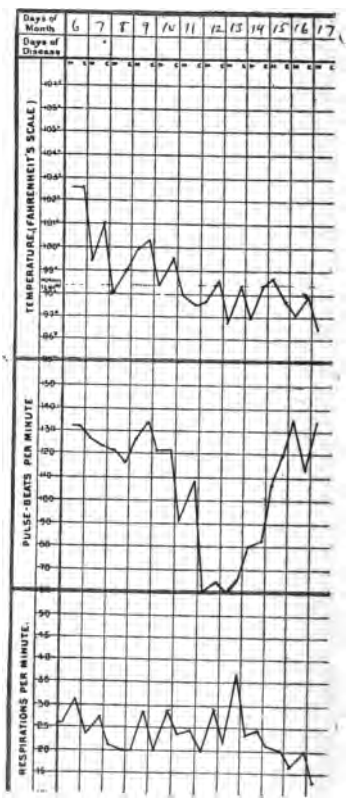
Days of Month
6 7 8 9 10 11 12 13 14 15 16 17
Days of Disease
TEMPERATURE (FAHRENHEIT'S SCALE)
PULSE-BEATS PER MINUTE
RESPIRATIONS PER MINUTE

Chart 4.

Post-mortem Examination. — Heart weight, 120 grms. Valves normal. At apex of left ventricle was a soft grayish red mass about the size of a bean, adherent to the wall and surrounded by soft grayish and mushy fluid. The myocardium showed pale yellowish streaked appearance, especially opposite this mass, where the wall appeared to be thinned. Both auricular appendages contained adherent reddish gray masses, the one in the left auricle showed softening similar to that in the ventricle. Cavity of ventricle much dilated and its walls thinned. Teased preparations showed much fat. Anatomical diagnosis was: Diphtheritic pharyngitis and œsophagitis; slight acute broncho-pneumonia of lower lobes of both lungs;

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acute general lymphatic hyperplasia. Acute dilatation of left ventricle with adherent softened thrombus at apex. Thrombos is of both auricular appendages with softening of the one in the right.

Microscopical Examination. — Pneumogastric nerve. The fibres are gray in color, granular and swollen. Some of them show a considerable amount of fat, chiefly lying in the myelin sheath, but not in large drops. The axis cyclinders are swollen and indistinct.

Cord. Sections stained by Marchi's method show a marked degeneration of the anterior and posterior nerve roots, and a diffuse degeneration throughout the white substance of the cord, most marked in the posterior columns. The cells stained by Nissl's method show indistinct or absent nuclear membrane, nucleus stained, and vacuolated nucleolus. Occasionally the granules at the periphery of the cells appear fewer then normal.

Medulla. Sections stained by Marchi's method show diffuse fatty changes, most marked in the fillet and in the internal arcuate fibres. In some of the nerve cells the nuclear membrane is indistinct, the nucleus stains homogeneously, the nucleolus is enlarged and often vacuolated. The granules are distinct. Occasionally a cell is seen where the nucleus is dislocated and the granules at the periphery of the cell have disapppeared.

Case XIV. — Boy, aged five years. Had measles. Admitted July 19, 1897, with diphtheria of two weeks' duration; was in a marked septic condition. Pulse, 78, weak and irregular. During the night color became bad, and he failed rapidly and died. No note of paralysis.

Post-mortem Examination. — There was diphtheritic pharyngitis, tonsillitis, glossitis; congestion of the lungs, spleen, and liver, with ascites and hydrothorax. Heart enlarged; weight, 140 grms. Left ventricle dilated; both sides contained clotted blood. Both mitral and tricuspid valves seemed somewhat dilated. Skin over thorax edematous. Abdomen contained about 20 cc. of serous fluid. Both pleural cavities contained considerable serous fluid. Pericardium showed an increase of fluid. Anatomical diagnosis: Diphtheritic pharyngitis, tonsillitis, glossitis, epiglottiditis. Dilatation of heart. Chronic passive congestion of lungs, spleen, and liver. Ascites and hydrothorax.

Microscopical Examination. — Pneumogastric nerve; sections showed rather slight degenerative process. A moderate number of fibres were grayish in color and irregular in outline, with occasional fat drops. The axis cylinders were swollen and beaded in the affected fibres.

It is difficult to judge of the frequency of heart failure as a cause of death in diphtheria because of the impossibility, at times, of saying which is the most important factor of several conditions. All sudden deaths in this disease, eliminating stenosis of the respiratory tract and paralysis of the muscles of respiration cannot be explained by heart failure. Acute glomerulo-nephritis will occasionally produce a rapid and fatal termination, and only the microscopical examination of the kidney reveals the true pathology. Thrombi and emboli

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are now and then found, but are probably secondary to the changes in the heart muscle. According to McCollom, in 121 cases of diphtheria, cause of death, verified by autopsy in 71 cases, was as follows: Extension of membrane, 39 instances; broncho-pneumonia, 29; sepsis, 29; cardiac complications, 19; abscess of the lungs, 2; tuberculosis, 2; thrombosis of lateral sinuses, 1. A conservative estimate of the frequency of heart failure in diphtheria would seem to be about 20% of all deaths.

Sex. — In the fourteen cases of death from heart failure included in this paper eleven were males, and three females. In 121 consecutive deaths from diphtheria that occurred in the hospital during this time 73 were male, and 48 female, out of a total of 343 males and 427 females admitted. We will not attempt to account for this apparent greater mortality in the males of Boston,[1] from diphtheria, and especially from heart failure:

Age. — This varied from seven months to twelve years in this series, the average age being five and a half years. Nine out of 121 consecutive deaths from diphtheria were in patients older than twelve years; in none of the nine was heart failure the cause of death.

Location of Membrane. — This was usually both in the nose and throat in these cases. In two instances it was on the tonsils alone (I. and VIII.), once on the larynx (V.), and once on both tonsils and in the larynx. In all but three cases more or less septic odor was noticed, and in four cases there were ecchymoses upon the body.

Albuminuria. — This varied from the slightest possible trace of albumin to one-eighth of one per cent. In six cases there was as much as one-tenth of one per cent.

Duration. — The time in the course of the disease when the first symptoms appeared showing any abnormality of the action of the heart, varied from the end of the first week to the beginning of the third, but generally it was observed within the second week. The duration of life after the first

[1] The report of the Health Department of Boston for 1895 and 1896 shows the total deaths by sex as follows, in diphtheria:

	Males.	Females.
1895	307	281
1896	279	237

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appearance of cardiac symptoms varied from a few hours to five weeks. However, there was usually some warning of danger a day or so before the end. Ten of the cases died within five days. The total duration of the illness varied from seven to forty-three days, the average being nineteen days.

Symptoms. — Some abnormal condition of the pulse, as a rule, first called attention to the heart. This was usually a weak, a very slow or high pulse rate, or an irregular pulse.

The maximum pulse rate was:

Less than 120 in 3 cases.
Less than 130 in 4 cases.
Less than 140 in 2 cases.
Less than 160 in 3 cases.

The minimum:

65 or less in 5 cases.
80 or less in 4 cases.
90 or less in 2 cases.
100 or less in 2 cases.

A rapid pulse of 140 or over was usually preceded a few days by a slow pulse of 70 or less. Again, a low rate of 80 or less was more frequent than a high one of 140 or more. In other words, bradycardia in these cases was a more common symptom of heart failure than tachycardia.

Irregularity of the pulse was observed in every case, where there were careful records, and intermittency was noted in four cases.

The area of cardiac dulness in eight patients extended from 1.5 to 3.5 cm. outside of the mammary line, and from 1 to 3 cm. to the right of the sternum.

A systolic murmur was heard at the apex in seven cases, and in every case more or less cardiac dilatation was made out by percussion. In only one case (VI.) was there considerable dilatation without an apicial systolic murmur.

A *bruit de galop* was observed in four cases, generally it was first heard a few hours before death. In case XIII. it was noted two days prior to the end. In three other cases of diphtheria, where this sign was heard for a few days and then disappeared, one recovered, one died from pneumonia

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and the other from pericarditis. There was marked dilatation of the heart in each of these seven cases of cantering rhythm.

A reduplication of the second sound was observed in two cases (VII. and XI.).

The weight of the heart. — The table below gives the sex, the age, the duration of illness, the weight in grammes, the average weight for the corresponding age approximated from Oppenheimer's paper and the recent text-books of Rotch and Holt, the average weight in diphtheria cases in general according to averages made from the hospital post-mortem records where there were five or more cases of that age, the increase according to the average in literature, and the increase plus or minus according to our tables for diphtheria cases.

Cases.	Sex.	Age.	Duration, days.	Weight of heart.	Average weight in literature.	Average weight in diphtheria.	Increase according to literature.	Increase according to B. C. H. Tables for diphtheria.
I.....	M.	8	15	180	100	138	+80	+42
II.....	F.	2	20	50	55	62	—5	—12
III.....	M.	6	19	135	80	102	+55	+23
IV.....	M.	7-12	7	45	33	.....	+12	.....
V.....	M.	3	16	65	65	75	0	—10
VI.....	F.	12	17	160	160	.....	0	.....
VII.....	M.	8	22	155	100	138	+55	+17
VIII.....	M.	5	17	120	70	98	+50	+22
IX.....	M.	6	11	90	80	102	+10	—12
X.....	F.	2 1-2	9	75	60	68	+15	+7
XI.....	M.	6	43	115	80	102	+35	+13
XII.....	M.	6 1-2	11	105	85	105	+30	0
XIII.....	F.	7	13	120	90	108	+30	+12
XIV.....	M.	5	15	140	70	98	+70	+42

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It is to be regretted that the body weight is not known so that the relative size of the heart to the body could be estimated. The table shows that there is a uniform increase in weight according to literature in eleven of the fourteen cases varying from 10 to 80 grammes, in eight it was 30 or more, while the average for all was 30. It might be said that it is not allowable to compare the weight in these cases with those in literature as they might not have been weighed in the same manner. To meet this objection the average weight of the heart in different ages was calculated from the weight of ninety post-mortem examinations of children dead from diphtheria, including the cases of heart failure considered in this paper. These last cases bring up the average; for example, for the age of six years, the average of the ten cases was 102 grammes, while eliminating five that died of heart complication it was 89 grammes. On the basis of our average there was an increase in eight cases out of twelve, and it would have been more if we had taken only cases that died of diphtheria, in which the cause of death was not heart failure. This cause of increase in weight is probably due in some instances to edema, and in others to the infiltration of cells in the muscle of the heart. The average increase of weight of the heart of those that were sick over a fortnight was just twice what it was in those who were ill less than that period.

Ten cases died in collapse. In the last four of this series of cases there was a progressive and gradual heart failure.

Vomiting was present in eleven of fourteen cases, and in five instances death followed within a day after the vomiting appeared. In three cases the patient complained of great pain in the epigastrium which seemed too severe to be explained by the vomiting alone, but possibly due to a disturbance of the pneumogastric nerve.

Paralysis of greater or less degree was noted in half of the cases, while in the other half there was no record made of its presence or absence. The parts usually affected were the palate and muscles used in swallowing, the muscles of accommodation in the eyes; and the reflexes were diminished, especially the knee-jerk. So common is paralysis of the

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palate in cases of heart failure that all patients who have this symptom should be confined to bed and kept absolutely quiet for fear of cardiac complication. In one case (VI.) the paralysis was so complete that, even before there was any cardiac symptoms, the friends were told that heart failure would probably occur.

Cardiac thrombi were observed in two of these cases (VII. and IX.) but in only one (IX.) did the thrombi appear to have been an important factor in causing death. How often these thrombi may be a cause of death it is difficult or impossible to say. Cadet de Grassicourt thinks that they are formed during the death agony. The formation of these thrombi is most probably to be explained by the abnormally slow circulation of the blood in the heart in these cases, produced by the weak heart action. Another important factor is probably the abnormal condition of the myocardium and endocardium from inflammatory infiltration, as in case X. of this series, which becomes the starting point of the formation of thrombi.

A resumé of the conditions that are often associated with a weak heart action which were observed in these cases, either macroscopically or microscopically, shows that hydropericardium was noted twice, hydrothorax three times, ascites four times. There was a congestion of the lungs, liver, kidney and spleen recorded in over half of the cases, varying in degree from a simple to a chronic passive congestion.

The other symptoms than those mentioned above, which are dependent partly upon the intoxication and partly upon the weak cardiac action, should be briefly mentioned. The marked pallor of the patient, the cold hands and feet, often covered with cold perspiration, and a subnormal temperature, are quite generally seen. The mental faculties are usually sluggish. The child pays little or no attention to the events that transpire about it, will not talk or reply to questions, takes its food unwillingly, if at all. In some cases there is difficulty in breathing, the respiration is rapid and shallow, and in the vain endeavor to obtain sufficient oxygen the child rolls about the crib until exhausted. The expression of the patient's face alone often informs the physician of the sud-

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den onset of cardiac complications. It has an anxious look, the eyes are surrounded by dark rings, and there are white lines about the mouth, and other changes which are difficult to describe.

Treatment. — Prophylactic measures are of the greatest importance. The essential thing, after a diagnosis of probable diphtheria is made, is the energetic administration of antitoxin serum in sufficiently large and frequent doses to stop the diphtheritic process. It should be the rule to keep all diphtheritic patients in bed until the membrane has disappeared; and those who have been prostrated to any degree should remain in the recumbent position for at least a fortnight, even when there has been no paralysis, poor heart action, or other outward sign. A rapid convalescence in diphtheria is not to be expected, and the physician should ever impress this upon the patient, even when the course of the disease seems to be favorable. In those cases which have any of the symptoms of cardiac involvement, extra caution must be taken that no additional work is required of the heart. The patient should be kept as nearly absolutely quiet as possible, both in body and mind. The general condition of the patient should be maintained by careful feeding. The medicinal treatment is in the main symptomatic, by the use of alcohol, digitalis, strophanthus, strychnia, caffeine, and occasionally nitroglycerine.

The character of the pulse and the heart's action should be constantly watched during the progress of the disease in order to see the effect of the drugs. When the condition begins to improve, if it does, the rule to make haste slowly in getting the patient up should be strictly adhered to.

By the use of the above precautions there is no doubt that cardiac complications may be prevented in many instances, and weak hearts carried over a period which would otherwise have proved fatal.

The pathological conditions found in these cases consisted of two varieties, the changes in the nerve structure, and those in the heart muscle. The changes in the pneumogastric nerve were always those of a degenerative process, acute in course, as shown by the breaking up of the myelin

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into simpler forms, so that it was stained by osmic acid, or as shown by the abnormal appearance of the myelin. The changes in the nerve cells of the medulla were probably part of the same process, and showed in the cells of the nuclei of the cranial nerves, as well as in those of the anterior horns. These changes were the altered staining reactions of the nuclei and of the nucleoli, and in some cases slight chromatolysis of the protoplasmic granules.

The heart muscle showed in several cases fatty degeneration of the muscle fibres, either in the hardened or in the fresh specimen, and other parenchymatous changes, shown by the loss of the striations and the vacuolization and atrophic changes of the fibres. The dilatation of the vessels was marked, and also the cellular infiltration in the interstitial tissue. This infiltration varied somewhat in character in different cases, and even in different parts of the same specimen. Most commonly it was composed of a variety of cells, epithelioid, lymphoid, and plasma cells. Eosinophile cells were also occasionally found. The edema of the heart muscle was also noticeable, and to this and to the infiltration we must ascribe the increase in the weights of the heart noted in these cases.

Dr. Councilman sums up the changes found in the heart muscle in diphtheria as follows:

Degeneration of the myocardium is one of the most common conditions found in diphtheria. The simplest form of this is fatty degeneration, which is found in the majority of all cases. This varies in extent, at times affecting the myocardium generally, at times occurring in foci. It may appear only in the form of fine granules at the junction of the cross and longitudinal striations or in large globules which involve the greater part of the substance of the muscle cell. The fatty degeneration accompanies and seems to precede the more advanced forms of degeneration which lead to the complete destruction of the muscle. In this there is destruction of the muscle rods, which become swollen, broken up, and converted into large hyaline masses. In other cases large vacuoles are formed in the cell, which differ in size and in their irregularity of shape from the fat vacuoles. Frag-

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mentation and fracture of the degenerated muscle cells is often found, but the segmentation or separation of the cells along the line of junction does not take place, or is very limited in extent. Simple fatty degeneration is found in the severe cases of short duration, the more extensive degenerations in the more prolonged cases. The degenerations may be so extensive as to account fully for the impairment of the heart action. No bacteria are found in connection with the degeneration, but like most lesions of the disease it is due to the influences of the toxic substances in the blood.

Acute interstitial lesions of two sorts are found. In one there are focal collections of plasma and lymphoid cells in the tissue, which may be accompanied by degeneration of the myocardium, but is not dependent upon it. This condition is analagous to acute interstital nephritis. In the other condition the interstitial change consists in a proliferation of the cells of the tissue, and is secondary to the degeneration of the muscle. It is probable that this may lead to extensive formation of connective tissue, and some of the cases of fibrous myocarditis may be due to this.

Thrombosis is not an uncommon condition, and is due to primary necrosis of the endocardium. Lesions of the vessels of the heart play but little part; the only lesions of interest are proliferation of the intima, the same lesion which is frequently found in the vessels in other organs.

Such changes in the heart muscle must affect the power of this organ to perform its work, and give weight to the view that the cause of sudden death in diphtheria is due to the muscle changes. On the other hand the changes in the pneumogastric nerves and the nerve cells were very constant, though not always extensive. However, we must remember that a degenerated fibre does not show marked changes throughout its whole length, but that the change varies in different parts of the same fibre, a fact for which sufficient allowance has not been made in discussing the effect of nerve changes upon the function of the nerve. The objection of Unruh that sudden death in diphtheria is an early accident, while paralysis is a late one, does not hold when we see that sudden death may occur late in the disease, and the

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paralysis may appear very early. In fact, paralysis was noted in eight of the cases of this series, and in one other case it was noted that the voice was very weak. The view of Hesse, that the heart failure results from the effects of the poison of the disease upon the heart rather than a result directly either of the muscle or of the nerve degeneration, seems nearer the truth. We must ask, however, in what way the poison acts. It seems most probable that in these cases it acts through the nerve structures interfering with their normal function, and that this may occur before degenerative processes have proceeded far does not lessen in any way the importance of their occurrence, but would rather lead us to place greater weight upon slight changes, if extensive, where other obvious causes of death, as glomerulonephritis, or markedly degenerated heart muscle do not exist. The greater constancy of the changes in the nerve, though slight, tends to confirm this view. Nevertheless the variability of the amount of changes, both in the heart muscle and the nerves, may point to a varying cause for these cases of sudden death, but it seems to us that the argument in favor of a disturbance of the function of the nerve is the stronger.

To sum up then, we may conclude that —

1. About one death in five from diphtheria is due to heart failure.

2. This is a more frequent cause of death in children than in adults.

3. The first signs of the failure of the heart usually appear during the second week of the disease.

4. A slow pulse is a more common symptom of serious cardiac trouble than a rapid one.

5. There is gradual degeneration of the heart muscle in these cases, accompanied by edema and interstitial infiltration, to which is due the increase of weight of the heart observed.

6. There is very constant degenerative change in the pneumogastric nerve, as well as elsewhere in the nervous system, in cases of diphtheria.

7. Probably these cases of sudden death are due to the effects of the toxic substance produced in the disease upon the nerve structures of the heart.

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8. Patients who have a weak, irregular, very slow or very rapid pulse; a dilated heart with a systolic murmur at the apex, a *bruit de galop;* a reduplicated second sound; a paralysis of the palate, or vomiting, should be considered as cases especially liable to heart failure, and therefore cases requiring extra precautions to avoid this complication.

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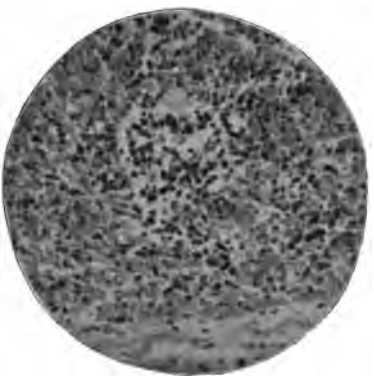

FIG. 1.

FIG. 2.

FIG. 3.

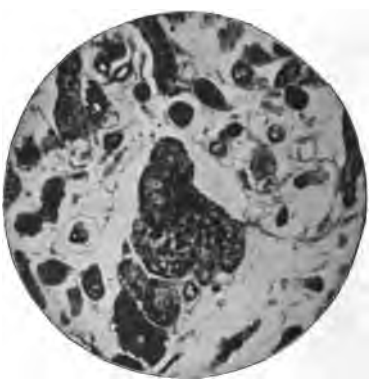

FIG. 4.

PLATES.

Fig. 1. Low power: Shows interstitial infiltration of heart muscle with lymphoid and plasma cells.

Fig. 2. High power: Shows the same condition.

Fig. 3. High power: Shows fatty degeneration and atrophy of muscle fibres. Moderate amount of edema and very slight infiltration.

Fig. 4. High power: Shows very marked condition of atrophy and fatty degeneration of the muscle fibres, with intense edema. Comparatively few lymphoid and plasma cells.

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XVIII.

REPORT OF A CASE OF PRIMARY SARCOMA OF THE STOMACH.

By Horace D. Arnold, M.D.

Primary sarcoma of the stomach is of sufficient rarity to warrant the report of single cases. The present case is the only one in which this diagnosis has been made by the pathological department of the Boston City Hospital. Schlesinger[1] in 1897, in an elaborate review of the subject, reported only thirty-three cases from medical literature, and added three of his own. The rarity of the affection is emphasized by Dock[2] in a paper read before the Association of American Physicians, May 3, 1900, in which he refers to thirteen other recorded cases not reported by Schlesinger. He also reports a unique case of primary lympho-sarcoma of the stomach. The tumor was situated on the posterior wall of the stomach, and projected into the lumen of the pylorus and obstructed that orifice. It was successfully removed by pylorectomy, and the patient was in good health, and was still gaining weight five months afterwards.

The successful relief in this case emphasizes the obvious desirability of discovering the affection in its earlier stages, when operative interference promises a possible cure and at least relief. Up to the present time the number of reported cases is too small to warrant definite conclusions which might aid in an early diagnosis. Hence the importance of recording well-authenticated cases as a basis for future generalization.

The following case first came under the writer's observation in the out-patient department. I am indebted to Dr. F.

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H. Williams and to Dr. J. C. Munro for permission to report the progress of the case while successively under their charge in the hospital wards, and to the pathological department for the report of the autopsy.

D. McL., male, forty-seven years old, married, of American birth, working as a cooper in a brewery, came to the hospital March 31, 1898, on account of pain in the epigastrium and increasing weakness. The family history was good. Malaria seventeen years ago, and influenza five years ago, were the only diseases remembered. There was no history of venereal disease. He had been employed as cooper in a brewery for eighteen years, and consumed the regular allowance of ten pints of beer daily. He did not use alcohol in other forms, and did not use tobacco. He had considered himself in good health up to the present ailment.

Present Illness. — Eight weeks ago he gave up work on account of a gnawing pain in the epigastrium and general weakness. These symptoms had attracted his attention at about the same time, and had existed but a very short time before he stopped work. The pain had been somewhat variable, but on the whole was increasing. His weakness had grown steadily worse. During the eight weeks his weight fell from 172 to 150 pounds. Of late he had noticed a spot sore to pressure in the left epigastrium. There was anorexia, some eructation of gas (which relieved the pain), and some nausea, but no vomiting. The bowels were constipated. He had no other symptoms. The gastric symptoms had not been noticed before the onset of pain about eight weeks previous.

Physical Examination. — He was of medium height, well developed and well nourished. His expression was anxious and depressed, and he was moderately pale, but he showed no cachectic look. There was no œdema. Reflexes were normal. Examination of heart and lungs was negative. Liver dulness extended from the fifth rib to just below the costal margin. The abdomen was moderately distended and uniformly tympanitic, except at the location of the tumor to be described.

A large abdominal tumor was felt in the left epigastric and hypochondriac regions. It extended out from beneath the costal border half way to the umbilicus. The part which was palpable extended upwards into the epigastrium nearly to the median line, and then disappeared under the left border of the costal arch, while the lower margin of the mass reached to within one and a half inches of the crest of the ilium. The tumor descended with inspiration. Above the costal border the extent of the tumor could be traced by percussion. Dulness extended upwards and backwards to include the area of the spleen, from which it could not be differentiated. It reached as high as the seventh rib in the anterior axillary line. The location and shape of the tumor strongly suggested an enlarged spleen. Moreover, a distinct indentation of the inner border might well correspond to the hilus of an enlarged spleen. The border and surface of the tumor, however, were irregular and distinctly nodular.

The examination of the urine was negative. The blood-count showed

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4,400,000 red corpuscles, and 15,600 leucocytes two hours after breakfast. A differential count of white cells showed:

Polymorphonuclear neutrophiles	79%
Basophiles	20%
Eosinophiles	1%

No myelocytes or altered red corpuscles were found.

The tumor was thought to be malignant from its nodular character and the rapid loss of weight and strength, notwithstanding the absence of a cachectic hue. From its shape and location the spleen was thought to be the organ most probably affected. The splenic flexure of the colon was considered, but there had been only moderate constipation, and it was thought that a tumor of the colon of this size must more completely obstruct the bowel. It seemed unlikely that a malignant tumor of the stomach would attain such dimensions without developing gastric symptoms previous to eight weeks before. Nevertheless, the examination of the stomach contents was contemplated for diagnostic purposes.

Two days later, April 2, he reported that the bowels had moved satisfactorily with Epsom salts. The examination of the stomach contents was planned for his next visit, but he became worse and entered the medical ward, April 5.

He complained of greater weakness than a few days before, that his bowels had not moved for three days, although Epsom salts had been used, and that he had colicky pains all through the abdomen. He had vomited once on the day before admission. The physical examination was the same except for greater distention of the abdomen. Leucocytes, 13,050.

During a stay of ten days in the medical ward he grew weaker. Obstipation continued. After a free use of cathartics and enemata there were two dejections, April 10, and one dejection, April 11. After that all efforts to secure a passage from the bowels failed. The vomiting had been slight at first, once or twice daily. It gradually increased, and on April 15 became stercoraceous. Surgical advice was sought, and an exploratory laparotomy was advised.

At the operation the rectum and sigmoid flexure were found free from any cause for obstruction. In the left hypochondrium was a large, hard, nodular tumor, surrounded by omentum. The descending colon was collapsed below the tumor, but above it the transverse colon was much distended. It was thought at the operation also that the malignant tumor involved the spleen primarily or secondarily, and that the involvement of the bowel was again secondary to this.

Owing to the poor condition of the patient the operation was cut short, and for purposes of relief a piece of small intestine was sutured in the wound and opened. Gas and liquid fæces escaped. For five days, up to April 20, the patient improved. He was much relieved; gas and fæces escaped from the wound; the distention was much reduced and his pulse improved. There was no fever. On April 21 distention set in again, and he sank rapidly, and died in a few hours.

At the autopy, on opening the abdominal cavity, the cæcum, ascending colon, and transverse colon were found enormously distended and filled

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with gas and liquid fæces. The distended cæcum occupied about one-third of the abdominal cavity. The small intestine was moderately distended with gas, and showed the operation wound in the upper part of the ilium. In the region of the splenic flexure of the colon was a large, firm, hard, nodular mass, examination of which showed that it was composed of the greater curvature of the stomach, colon, and omentum bound together by a firm and nodular growth. The spleen was not involved, but was lying in close juxtaposition with the tumor.

In the stomach the lesser curvature, cardiac and pyloric regions were normal except for hæmorrhages beneath the mucous membrane. The remainder of the stomach showed nodular, firm masses beneath the mucous membrane, which on section were yellowish white, ½ to 2 centimetres in diameter. At the end of the tumor mass on the greater curvature nearest to pylorus was a large crater-like excavation, with elevated, irregular edges, the base being covered with a dirty, sloughing material. From the base of this excavation a partly firm, partly necrotic mass extends to splenic flexure of colon. The pancreas is evidently involved, as its structure can not be made out. The centre of the mass was semi-fluid.

The wall of the colon for a distance of 7 centimetres was thickened, firm, and nodular, the lumen being constricted. At a point directly opposite the mass between the stomach and colon the lumen of the colon was completely obliterated. The omentum was shrivelled and contained many small nodules. The gastro-hepatic glands were enlarged and firm. No parts of the intestine other than those described showed any abnormal changes.

The spleen weighed 85 grammes. It was grayish-red in color, flabby, no increase in pulp, the Malpighian bodies not enlarged, and the capsule normal.

Summary of other organs: Fatty degeneration of liver; slight chronic pericarditis; arterio-sclerosis of aorta. The kidneys, adrenals, bladder, prostate, testicles, pleural cavities, heart, lungs, and bronchial glands were all normal. The head was not opened.

The malignant growth was evidently primary in the stomach and involved the other structures by extension.

The microscopic examination of the stomach and other tissues affected shows a diffuse infiltrating growth in which are numerous areas of necrosis, usually distinctly circumscribed. The tumor cells are irregular in shape, and have large, lightly staining, round, oval, or irregular, vesicular nuclei and prominent nucleoli. Mitotic figures are very numerous. The cells vary much in shape; some are rounded, others irregular, or elongated. The protoplasm is very finely granular and tends to stain lightly with nuclear (methylene-blue) stain; it often shows projections and short processes. The tumor cells infiltrate muscle and other tissues in a very diffuse manner, apparently by extension along the lymph spaces to the walls of which they cling tenaciously. Nowhere can any evidence of an alveolar arrangement be found. A few of the tumor cells contain more or less digested cellular inclusions.

The growth is evidently of mesenchymal origin, and should be classed as a mixed-cell sarcoma, or perhaps better as an endothelioma.

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In this case it is evident that at the time he first applied for treatment, surgical interference for the removal of the tumor was no longer possible. It was probably too late when he first noticed symptoms about eight weeks before that, for during the three weeks he was under observation the tumor did not increase in size perceptibly, and it is hardly conceivable that only eight weeks earlier it could have come within the range of legitimate radical surgical treatment. Our case then brings nothing but discouragement to the problem suggested by such cases as the one reported by Dock, namely, to ascertain the early symptoms in the hope that by the early recognition of the disease something effective may be done through surgical aid.

As before remarked, the number of cases observed is too small to warrant safe generalization. However, it may be noted that in a considerable number of cases, as in this one, symptoms do not attract the patient's attention until the disease is well advanced. This is probably due in part to the fact that the growth starts in the deeper tissues of the stomach wall, and that the mucous membrane may not be involved until late in the disease, when it ulcerates from pressure. Furthermore, those cases which are free from symptoms for an unusual length of time frequently involve the body of the stomach, and not the neighborhood of its orifices. The stomach is much more tolerant of tumors so situated. In those cases where sarcomata involve the orifices of the stomach the symptoms are not dissimilar to those of carcinoma in the same location, and we have no means of clinically differentiating one from the other. By the time symptoms develop in these cases the practical question is whether or not we have malignant disease of the stomach, not whether we have carcinoma or sarcoma.

The practical point to be learned from the present case in reference to diagnosis is that a tumor in the upper part of the abdominal cavity may be connected with the stomach even though its location, size, and the absence of gastric symptoms suggest that such an association is highly improbable. The importance of the examination of the stomach contents when such a tumor is found is obvious, although

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the data collected in cases of sarcoma of the stomach are as yet meagre. Still information might be obtained which would point to the involvement of the stomach wall in the growth. It is to be regretted that such an examination was not made in this case, but the onset of symptoms of intestinal obstruction frustrated the plans already formed, and turned efforts for relief in another direction.

Another point which misled us in diagnosis was the surprising lateness of the appearance of signs of intestinal obstruction in a tumor which involved the colon in its growth. Notwithstanding the extent to which the wall of the colon was involved, and the fact that the lumen was entirely obliterated at the autopsy, he had up to three weeks before death noticed nothing but moderate constipation. The colicky pains so characteristic of an effort on the part of the bowel to force its contents by an obstruction appeared first only eighteen days before death, and some fœcal matter passed by as late as ten days before death. The probable explanation is a late involvement of the colon by the growth and a rapid process of growth at this point, although to external examination the tumor was not increasing.

With regard to the plausibility of the theory that the growth involved the spleen we were naturally misled by the location. It may be said in defence that even after the abdomen was opened at the autopsy nothing was found to throw doubt on this view until the whole mass was separated and turned out, bringing the spleen attached to the back of it but not involved in the growth.

The present status of the investigation of the subject of primary sarcoma of the stomach has recently been so ably presented by Schlesinger and Dock that it is only necessary to refer to their articles for the general discussion of the subject and for the literature.

(1) Schlesinger, Zeitschrift f. Klin. Med. Bd. xxxii., Supplement-Heft, 1897.

(2) Dock. Journal of the American Medical Association, vol. xxxv., No. iii., p. 156, 1900.

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XIX.

PERICARDITIS WITH EFFUSION.

By George G. Sears, M.D.

The present paper supplements one published in the Hospital Reports of two years ago, which was based on an analysis of one hundred cases of pericarditis, by taking up in more detail certain points in the diagnosis and treatment of pericardial effusion which have been especially studied in cases recently under observation. While a number of conditions may simulate a collection of fluid in the pericardium, practically the chief difficulty in diagnosis lies in its differentiation from marked cardiac enlargement unless the case has come early under observation and it has been possible either to watch the gradual accumulation of the fluid, or, rarely, to follow its fluctuations from day to day as illustrated by the following case, in which each relapse of the joint symptoms was accompanied by a demonstrable increase in the amount of pericardial effusion, both subsiding under increased doses of the salicylates.

Case I. — A colored boy, twenty-two years old, was admitted April 11, 1900, with a history of acute rheumatism of a month's duration, but without evidence of cardiac involvement. No murmurs were heard, but the second pulmonic sound was quite sharply accentuated. The following day friction sounds developed over the precordia. The area of cardiac dulness increased until on the 15th it extended nearly three inches to the right and four inches to the left of the midsternal line, and above to the top of the second rib. The point of cardiac impact farthest down and to the left, which may for convenience be called the apex beat, though probably made by a portion of the heart above the true apex, was situated in the fourth space, one-half an inch inside the nipple line. An area of dulness was present in the lower left back and axilla,

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merging anteriorly into that of the pericardium, over which the respiration was somewhat diminished and slightly bronchial, with increased voice. At the right base there was evidence of a small amount of fluid.

April 23d. The area of precordial dulness has decreased half an inch on the right side, but not on the left, and the apex can be faintly felt in the fifth space. The joints are improving.

April 29th. The apex is plainly felt in the fifth space, and apparently considerable of the pericardial fluid has been absorbed. The patient, however, is beginning to complain once more of his joints.

May 2d. Fluid has again increased, and some epigastric fullness is noticeable. The cardiac sounds are more feeble, and the apex beat is once more in the fourth space. There is evidence of fluid at the base of both lungs. The joints are quite painful.

May 3d. An attempt at aspiration was made to-day in the fourth space, one inch to the right of the sternal border. Although the needle moved freely in the pericardial sac and the heart could be plainly felt against its point, no fluid was obtained.

May 10th. The width of the cardiac area has again diminished, and the apex beat has moved back to the fifth space.

May 14th. Another relapse with a rise of temperature and pain and swelling in the hands and wrists. The apex beat has returned to the fourth space.

Later he gradually improved and was discharged against advice, with some fluid still remaining in the sac.

Where, however, no opportunity has been given for watching the progress of the case the extreme difficulty or perhaps impossibility of diagnosis is acknowledged by all writers, owing to the ambiguous character of most of the physical signs. The extension of the dulness beyond the apex beat points to the presence of pericardial effusion, although it is far from conclusive unless very marked, since it is found in cases of uncomplicated cardiac enlargement, while the lack of correspondence between the comparative strength of the radial pulse and the decided weakness of the impulse and sounds of a heart whose percussion outlines apparently show a great increase in size is also suggestive of the same condition. In spite, however, of the striking character of this increased area of dulness its shape is still variously described. To quote but three of the numerous authors who have recently written on the subject, Roberts says that it assumes "a more or less triangular, pyramidal, or, more strictly speaking, pyriform or pear-shaped outline with its truncated or 'peaked' apex above." Ewart says it resembles a bag of fluid spreading out at the base, while

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F. C. Shattuck describes it as simply that of "the normal heart equally extended in all directions. Therefore, of course, it is also that of a symmetrically enlarged heart, though the latter can seldom, if ever, produce so large a dull area." Both the latter have apparently given up the idea that it is ever pear-shaped, while Shattuck denies the pyramidal form. This may be only a question of definition, or it may be due, as he suggests, to the method of percussion adopted, which must give a different outline according as the outer border of the pericardium or the inner limits of the lungs are sought. My experience would confirm in most details the claims of the last two, but it is more in accord with Ewart than with Shattuck. I have never been able to mark out by percussion a pear-shaped outline, perhaps because, like Dr. Shattuck, I have always attempted, from greater confidence in the results, to define the outer border of the heart and not the limits of so-called cardiac flatness; nor have I ever obtained any outline which suggested the superposition of a smaller or a larger sphere, as was found by Sibson on artificially distending the sac with a moderate amount of fluid, either by percussion or with the skiograph, but my experience with the latter has been limited to few cases, since most of the patients have been too ill to allow their removal from the ward to the X-ray room. The outlines of these photographs lacked clearness of definition, but nevertheless were very similar to those obtained by percussion, and showed a general broadening of the area of precordial dulness, especially at its lower portion, the line on the left being nearly parallel to that which is found with a normal heart, while that on the right of the sternum either flared outward toward the nipple, giving a shape which at times was so symmetrical as to fully justify its comparison to a bag of fluid, or ran parallel to the sternal border as if a part of the right side of the bag had been shaved off vertically. It has seemed to me, as Ewart and others have stated, that in connection with the increased area of cardiac dulness the most important single sign of pericardial effusion, in distinction from cardiac enlargement, is the angle made by the line bounding the right side of the precordial dulness with that

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which marks the upper limit of hepatic flatness. In my experience no matter how large the heart, its percussion border is always a curved line, whose lower end tends to approach the sternum so that the angle made by the outlines of the enlarged heart and the liver on the chest wall is an acute one, or, at least, never exceeds ninety degrees. In fact, when the cardio-hepatic angle is equal to a right one the chances rather favor a pericardial effusion.

Secondary signs resulting from pressure or displacement can only be considered as corroborative evidence. The quadrilateral area of dulness in the lower left back, described by Ewart, was present in a number of cases, but it may also be found when there is very marked cardiac enlargement. More often it has formed a part of a larger area extending into the axilla and to the front, so that the whole lower portion of the chest has been dull, with diminished and somewhat bronchial respiration, or else the presence of secondary or coincident pleural effusions has robbed the sign of its significance.

The pulsus paradoxus, which occurs in pericardial effusion as in several other conditions, was found with considerable frequency, but not always when the quantity of fluid was large, as has been stated; in a few cases it has been well marked where the amount of exudate seemed comparatively small.

An accentuation of the pulmonic second sound has been described by Warthin as the earliest sign of pericarditis, and in my cases it has occurred sufficiently often to arouse one's suspicions that such a complication is developing when it is otherwise unexplained and persistent in diseases liable to cardiac accidents. Its presence has allowed me on one or two occasions to make what was a lucky but correct guess as to the possible course of future events.

In the early stages a sedative to quiet the heart, and in the later a stimulant were the only medicinal measures used. No attempt to control the effusion was made, but an ice bag or a poultice was applied if they comforted the patient or reduced the pulse rate. Blisters were never used, as their value seems doubtful, and they interfere with the examination of the chest; but tincture of iodine was applied if the patient

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demanded treatment. The chief interest from the therapeutic standpoint lay in the decision as to when and where to aspirate. The history of my own attempts is largely a record of failure, but no harm has ever resulted, and the marked relief to the patient which has once or twice followed the withdrawal of a few ounces of fluid has fully justified the procedure. While in pleurisy one expects to get fluid on the introduction of the needle, experience shows that a dry tap is by no means infrequent in pericardial effusion. It was so in Dr. Shattuck's published cases, and it has been even more so in mine. In some instances, even where there was no question that a very considerable amount existed, and where the needle moved freely in all directions after its introduction, and could be pushed up against the heart itself, no fluid, or at most a dram or two, could be drawn through the needle by the aspirator. This has been explained as resulting from the presence of flocculi in the exudate, or from its trabeculated or loculated nature. The site selected for puncture undoubtedly has an important bearing on the success of aspiration, but it is questionable if one position *per se* can be selected as better than another, so much depends on the position of the heart in its relation to the pericardial walls, which is not always constant. The close proximity of a friction rub even in the presence of a considerable amount of fluid has several times prevented me from using the fifth left space, the one most frequently recommended, from fear of wounding the heart, and with one exception I have found it inexpedient to adopt the route suggested by Dr. Shattuck, to the left of the apex beat, since the outer limit of the pericardium has been impossible to determine owing either to the presence of pleural fluid or to the dulness caused by compression or retraction of the left lung. Rotch, some years ago, after some experiments on the cadaver, pointed out the advantages of the fifth right space, and recently, Damsch has recommended either the fifth or sixth right space near the sternum, since he found in a series of similar experiments that the fluid collected in the lower right-hand portions of the pericardium. Although the fourth and fifth right spaces have been the ones more often selected in my cases, as the

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danger of wounding the heart seems smallest there, the proportion of productive taps has not been particularly encouraging.

The following cases, with the one reported at the beginning of this paper, comprise my whole experience in paracentesis of the pericardium. Cases IV. and V. have already been reported elsewhere, and are given only in outline:

Case II. — H. R., colored, male, twenty-three years old, entered the Massachusetts Hospital during my term as house physician, in the service of Dr. W. L. Richardson, to whom I am indebted for the privilege of reporting it, October 11, 1884, suffering from tuberculosis of the lungs and bowels. His chief complaint was of pain near the ensiform cartilage on drawing a long breath. Fluid gradually collected in the pericardium until almost the entire front of the chest, from the second rib downward, was dull on percussion. The abdomen became distended, particularly over its upper portion, which was dull on percussion and gave an indistinct sense of fluctuation. This local distention of the abdomen became so marked a feature that on October 24 a needle was thrust into the right side of the epigastrium, well below the costal border, and an ounce and a half of bloody fluid, slightly tinged with yellow and containing numerous red cells and leucocytes, was obtained.

Four days later an attempt at aspiration was made through the upper belly of the right rectus muscle, not far from the spot previously selected, but without result. On the left side, however, three or four ounces of bloody fluid were drawn off. He failed gradually, and died November 2. At the autopsy, which is reported from memory, as the records have unfortunately disappeared, almost the whole front of the chest was occupied by the distended pericardium, which had displaced the diaphragm and with it the liver and other abdominal organs, and was the cause of the tumor noticed in the epigastrium and upper abdomen. Over two quarts of bloody fluid were contained in the sac.

Case III. — M. N., male, twenty-four years old, admitted to the City Hospital, December 22, 1896, with acute rheumatism and a well-marked pericardial friction rub. The second sound at the base was very loud. Fluid gradually collected in the pericardium, and also in both pleural cavities, so that on January 3 the precordial distress and dyspnœa were very marked. An aspirating needle was introduced in the fourth space, a little to the left of the left edge of sternum. It moved freely in all directions, and the heart could be felt beating against it, but no fluid was obtained. Twenty-four ounces of serum were drawn from the right chest, with relief. He slowly improved, and was discharged "relieved," March 23.

Case IV. — S. B., male, twenty-three years old, admitted June 19, 1897, with acute rheumatism. He later developed a pneumonia of the left lower lobe and a pleurisy, with a small effusion in the right base. Fluid also gradually collected in the pericardial sac. The pulse varied between 110 and 120, and the respirations between 40 and 56. A needle introduced in the fourth right interspace, one inch from the sternal border,

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drew off ten ounces of bloody fluid, containing pneumococci. Improvement slowly followed, and he was discharged September 14.

Case V. — J. D., male, twenty-five years old, was admitted August 3, 1898, with mediastinal and pulmonary sarcoma. Fluid was present in both pleural cavities and in the pericardium. The following day sixteen ounces of bloody serum were withdrawn from the left back with marked improvement in the physical signs above the angle of the scapula. On the 5th an attempt was made to relieve the pericardium by inserting a needle in the sixth left space a little outside the mamillary line. Thirty-eight ounces of bloody fluid flowed out in vigorous jets synchronous with the heart, while a distinct pulsating movement was imparted to the needle itself. So much relief followed that at the request of the patient a further attempt was made on the following day in the fifth left space just outside the middle line, but nothing was obtained. The sixth space was then tried in the same position as before, but the result was negative. At the autopsy, which occurred less than two weeks later, the left pleura, from which fluid had been withdrawn, was completely obliterated, and so was the pericardial sac with the exception of a few small pockets.

Case VI. —T. M., male, thirty-eight years old, markedly alcoholic, admitted November 20, 1899, with a history of rheumatism of three weeks' duration. He was slightly delirious, and little reliance could be placed on his statements. The area of cardiac dulness was somewhat increased. The apex was in the fifth space, one-half inch outside the nipple line. A soft systolic murmur was heard both at the apex and over the aortic area. The second pulmonic sound was accentuated. On the 24th his delirium increased, and on the 28th he grew very hoarse. On December 2 a little consolidation was noted at the base of the right lung. The heart sounds had become distant and feeble, and the area of cardiac dulness extended to within an inch of the nipple line on the right, and on the left to just outside that line. A friction rub had been present for one day over the fourth left cartilage. Two days later the cardiac area extended on the right almost to the nipple, and on the left one inch and a half outside it. His respirations and pulse were rising, and he was evidently losing ground. A needle introduced in the fifth right space obtained three drams of flocculent fluid. Further attempts at aspiration were made on succeeding days by introducing the needle in the fifth left space, one inch and a half outside the nipple, and twice again in the fourth space. Although the tip of the needle in each instance moved freely as though in a cavity, the results were negative. He gradually failed, and death occurred on the 15th, to which his alcoholic excesses largely contributed.

To summarize these attempts: The fourth right space was used four times with one successful result; the fourth left space once, without result; the fifth left space, outside the apex, was no more successful on the one occasion it was used, but from the fifth right space three drams of fluid were obtained. From the sixth left space just outside the nipple

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line, the largest amount, thirty-eight ounces, was withdrawn; but owing to the equivocal nature of the physical signs it cannot be said with absolute certainty that it did not come from the pleura. The autopsy failed to throw light on this point. The fact that the fluid was twice obtained in one case below the margin of the ribs is a medical curiosity, and instructive as showing the amount of displacement which occurs with large effusions.

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XX.

PSYCHICAL EPILEPSY, WITH THE REPORT OF A CASE.

By J. W. Courtney, M.D.

In view of the enormous amount of literature which has appeared in the last few years on the subject of epilepsy, the following statement of the late Dr. Landon Carter Gray, in an article written by him only five years ago, is both interesting and significant. He says: . . . . "the physician himself seldom sees an attack, even if he be the resident of a hospital, for, while I have probably treated thousands of cases, I could easily count on my fingers all those that I have observed during the attack itself." Now, if Dr. Gray's utterance is true with regard to the ordinary convulsive attack, it is vastly more so with regard to the psychical form — a fact which gives to a personally observed case of the latter type, such as is to be related, sufficient importance to make it worthy of record. But before proceeding to this, a brief preliminary review of our present state of knowledge on the general subject of psychical epilepsy would seem not to be out of place.

By psychical epilepsy we understand those peculiar pathologic alterations of consciousness and memory which may precede, accompany, follow, or even, according to certain observers, take the place of the epileptic fit. Patho-physiologically considered, such states of mind are regarded as the result of inhibitory or irritative explosions within that portion of the cerebral cortical territory which presides over psychical processes. Hence simultaneous motor disturbances, the result of a synchronous inhibitory or irritative explosion primarily within the motor cortical territory, are constantly lack-

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ing. Nevertheless, associated motor phenomena, sometimes of the most complicated and purposive types, do occur, and to account for them properly we must consider them as end results of psychic processes. As a matter of fact, it is these very motor phenomena, which frequently manifest themselves in theft, burglary, acts of violence, murder even, that have lent to the subject of psychical epilepsy the great forensic importance which it possesses to-day. As Ottolenghi says: "It is to such epileptic accessions that we must often refer those enormous crimes which strike fear and terror to the heart of a community, and make it, overwhelmed with horror, cry vengeance against the human beast, the ferocious assassin, who often is none other than a pitiable epileptic, irresponsible for his misdeed."

For a long time this close association between epilepsy and crime has engaged the attention of alienists and criminologists all over the world, and it is to their untiring efforts that our present comprehensive knowledge of epileptic psychopathic phenomena is due.

Before entering upon a consideration of the varied disturbances of consciousness and memory which constitute the clinical expression of the psychopathic phenomena, it may be well to state that the epileptic is particularly prone to illusions and hallucinations. As a matter of fact, the epileptic brain constitutes a fertile soil for the formation of both of these types of morbid phenomena, which may exist independently of the convulsive attacks, may provoke the attack, or occur in the attack itself, forming in the last named, as a rule, the psychic aura.

The disturbances of consciousness and memory proper, with their consequences, are, however, the factors in psychical epilepsy which are of the greatest medico-legal importance, and deserve the most extended consideration. These have been divided by authorities into the two following groups:

(*a*) Those constituting the so-called intellectual petit mal; and

(*b*) Those constituting the so-called intellectual grand mal.

But it should be borne in mind that although these forms

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derive their names from the grand and the petty convulsive attacks they cannot be brought into any causal connection with them. Furthermore, that there is no correlation between the psychical attacks and the convulsive phenomena of the disease in one and the same individual.

INTELLECTUAL PETIT MAL.

In the simplest form of this type the loss of consciousness may be so slight as to escape observation, unless this be lengthy, complete and searching. Such losses of consciousness have been characterized as "absences or pauses of consciousness." In certain attacks the patient's glance becomes fixed in the distance, his face suddenly becomes pallid, his speech interrupted, his gesture arrested, and he remains apparently unconscious, and as if in an ecstasy. After a few moments consciousness returns, and he continues all forms of activity at the point at which he left off.

The obnubilation of the intelligence presents great variations in degree. At times it is so profound that the patient has absolutely no sense of what has happened; at others he sees vaguely the persons about him, but does not hear what is said, or *vice versa*. And afterward he is practically never able to reply correctly to what is said to him while in the attack. Should the attack come on while he is walking about the walk may not be interrupted. Sometimes it does not occasion a pause even in occupations which require delicate manipulation, as shaving, the patient being totally unaware that anything unusual has happened.

It is interesting to note here that Féré objects to the contention of many authorities that such manifestations are the result of inhibitory or irritative explosions in the purely psychical areas of the cerebral cortex, without synchronous explosions in the motor areas, because, as he says, whereas certain patients during the attack merely drop whatever object may be in their hands, others project it to a distance. This author further supports his objection by myographic tracings which show the presence of slight muscular jerkings in both upper and lower extremities, synchronous with the onset of the "absence."

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Although the integrity of the intelligence seems frequently to be restored at the end of the absence, this is not always so. It may remain clouded for several minutes, during which the patient appears as if astonished, and not in normal touch with the situation; or the obnubilation may continue for hours.

In the more prolonged and severe attacks of the intellectual petit mal type there may occur the most varied motor phenomena as end-results of perverted ideation. Such attacks often manifest themselves suddenly, after a short incubatory period of melancholic depression, by a condition of profound anxiety, and are characterized by marked confusion, considerable irritability, impulsions — all of which the patient may recognize as pathologic — and by imperative ideas. Overwhelming *tedium vitæ* may then take possession of the patient and betray itself in suicidal attempts of the most loathsome sort. During this same condition certain patients repeat incoherent words, take off their clothing, strike those about them, or commit acts of theft and incendiarism; others exhibit their genitals, while others still, yielding to impulses, leave their homes and walk straight before them for a longer or shorter period of time. It is among this last group that we find those interesting cases of ambulatory automatism of long duration, in which the patient may go about for many days, or even weeks, performing the most complicated acts without attracting attention to his condition, and may not come to himself until he is hundreds of miles from home. During the whole period of this so-called automatic state he may give proof of his power of initiative, act just as he would in ordinary health, retain a recollection for memories already acquired, and not lose consciousness of such automatic acts until he comes to himself. This twilight state of consciousness (the "Dämmerzustand" of the Germans and the "stato crepuscolare" of the Italians) together with the variations in the character and degree of amnesia to which it leads, are among the most important considerations, from a medico-legal standpoint, in the whole domain of epilepsy, and will be considered more fully later in connection with amnesia.

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INTELLECTUAL GRAND MAL.

The question whether this type of epileptic psychosis is an absolute equivalent to the grand convulsive attack, as it is held to be by certain observers, is still an open one of great interest and importance. Legrand du Saulle claims that every insane outburst of this type is invariably preceded by some well recognized epileptic manifestations, such as rudimentary and abortive paroxysms or a nocturnal attack, and alleges lack of thoroughness of research on the part of those who regard such outburst as a pure equivalent. Be this as it may, there is at least one fact in reference to this particular type of psychosis which seems to be proven by accumulated experience, namely, that it can never, in a given case, be regarded as the first symptom of epilepsy. To establish its claim to be considered as epileptic in character other well-recognized manifestations of the disease must be shown to have preceded it. The medico-legal importance of this fact will be apparent when we come to the question of diagnosis.

Attacks of intellectual grand mal generally occur after very brief prodromes, and manifest themselves, in contradistinction to the ordinary petit mal types, by impulsive acts of the greatest ferocity, directed against the sufferer himself or against others. The basis of these impulsive acts is usually composed of a mixture of anger and fear sensations, and of terrifying and threatening hallucinations. After committing acts of the most brutal ferocity the patient may sink into a profound slumber, surrounded by the most damning evidences of his crime, and awake therefrom with a complete amnesia for the attack and everything connected therewith. In certain cases the attack may last for several hours or several weeks, and in the latter type a remittent character is not infrequently observed. During these remissions, which may last for some hours, the patient may be clearer and quieter, or he may sink into a deep sleep, from which he awakes fully deranged as before, and either stuporous or thoroughly excited.

According to Falret and others a primary incoherence or dissociation of ideas is the most essential feature of the dis-

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ease-picture. All other symptoms group themselves in the most widely varying intensity and manifoldness about this psychopathological basal phenomenon, which also plays the greatest part in the dreamlike character of the attack. The special form which the psychosis will take in a given case is determined by variations in the pathological play of the passions, as well as by the number and content of the hallucinations. If there is a marked inhibition of thought processes, the element of incoherence retires into the background, and a marked stuporousness takes its place. Patients of this type remain mute, unparticipative, withdrawn within themselves until a more powerful sensation of fear or anger, or a more active hallucination arouses them from this treacherous apathy and impels them to deeds of the most ferocious violence.

When incoherence alone is at play throughout the attack the patient is in a condition of the most marked motor excitation, which betrays itself by purposeless and senseless acts, by garrulous externalization of rapidly succeeding ideas and, at the height of the attack, by absolute verbigeration. And it is easy to determine, by his mimicry, gesticulations and speech, that he is under the spell of visions, of hallucinations of other special senses, or of illusions. He is fully disorientated, and the threads which bind him to the outer world are completely severed. He leads, in reality, a dream life, which, dissevered from all normal connections with the outer world, is governed only by fragmentatively arising ideational complexes or by hallucinations and illusions. In exceptional cases the hallucinations manifest themselves with great sensual liveliness. Animal shapes, deluges, representations of theft and murder crowd upon the patient and occasion ineffable terror, or incite him to defence or flight; or divine voices, rejoicing angels, or transfigured relatives deliver joyous messages to him. He sees soldiers marching, hears patriot songs resounding, cannons thundering, drums beating and trumpets calling; he rushes about the room in an ecstasy of patriotism, sings national songs, and cries "hurrah!" On the other hand, it may be shrieks from hell he imagines he hears; devils may assail him, and

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dreadful cries resound about him; a horrible smell may fill the room. In this case he huddles whimpering beneath the bed-clothes or cowers trembling in a corner of the room to escape the onslaught. He may even run swiftly from place to place in search of shelter, and this procursive tendency has led, on the part of certain observers, to the mistaken idea of a procursive epilepsy (epilepsia procursiva) as a clinical entity of the disease, whereas the phenomenon is in reality due to an insistent and monotonous cycle of imaginations, or to certain hallucinations.

THE PRE- AND POSTEPILEPTIC PSYCHOSES.

These forms of transitory mental disturbances are, to a certain extent, to be considered only as prolongations of the aura or as outgrowths of the soporous after-stage. The postparoxysmal form excels by far in frequency and extent. The preparoxysmal consists principally in increased irritability of the temper, great anxiety, markedly inhibited ideation, monotonous hallucinatory excitation or impulsions — less often in an extravagant good humor — and generally leads merely to motor reactions of a few hours' duration, which take the form of compulsory disordered activity or of acts impelled by fear and anger. The postparoxysmal psychoses, on the other hand present much closer analogies to the psychopathological phenomena of the so-called epileptic equivalent. They have been divided by Binswanger into the following groups:

a. Merely stuporous conditions, the result of inhibition of all intellectual and motor conductivity.

b. Attacks with ordered automatic acts.

c. Attacks with systematically arranged hallucinatory series, like certain dream-pictures, and

d. Attacks with stormy hallucinatory irritative phenomena, accompanied by marked incoherence and impulsive acts of violence.

A combination of two or more of these groups may be present in any case, and the clinical aspect naturally varies accordingly. It is noteworthy that protracted stuporous conditions, which may extend over many days or even weeks, prevail more commonly in the postparoxysmal conditions

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than in the equivalent, so called. Hence, we may have mutism, fixed and expressionless glance, slow pupillary reaction, diminution of the skin and tendon reflexes, varying flaccidity and cataleptiform rigidity of the body musculature, total analgesia of the skin and mucous membranes. If such attacks last for days they are generally interrupted, during periods of several hours' duration, by marked motor excitations, such as: Verbigeration, simple and combined compulsory acts, deeds of violence, etc., either with or without a recognizable hallucinatory basis.

As a rule this severe type of attack follows closely in the wake of the frequently repeated and serial form of epileptic convulsions. The convulsive series may be made up of the most varied combination of complete, rudimentary, or abortive attacks. The best measure of the probable severity is the longer or shorter interval which prevails between individual convulsions; the shorter the interval and the greater the mental and bodily degradation which follows, the more protracted and severe will be the psychosis at the end of the series. Binswanger has observed, in a less common group of cases where the transitory psychosis follows upon a single complete or abortive convulsive attack, that this outburst is the probable result of a postponement, by treatment or otherwise, of an attack which, if not interfered with, would tend to recur frequently.

In the amnesia which is intimately associated with all types of psychical epilepsy we have a subject of the greatest scientific and forensic importance, and the variations which it presents in form and degree lend a peculiar interest to its study. In the most prolonged "absences," those which may last for days, months or, even years, during which the patients think and act in a fashion analogous to their normal state and have a memory for their acts that ceases only when they "come to themselves," as it is called, we often observe an amnesia which is profound. This probably arises from the completeness of the doubling of the personality which takes place, there being not a single thread which binds the intellectual processes of the "twilight" with that of the normal state of consciousness. Complete amnesia of this type usually

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follows closely upon the very brief and violent insane outbursts which at times constitute the psychical equivalent of the epileptic convulsion. Here the amnesia is probably to be explained on the ground that in the pathological play and counterplay of inhibitory and irritative processes which dominate the psychical activity of the epileptic, the factors are not present that give rise to the production of memory-pictures in the ordinary course of associated ideas.

In other cases the amnesia is not so deep. In the less developed forms of the crepuscular state the memory defect is less marked. There are connecting links between the normal and abnormal which are made up of fragmentary memories of acts and experiences occurring during the attack.

One of the most interesting types of amnesia which occur in connection with epilepsy is the so-called "retroactive" type, in which the loss of memory goes back farther than the attack itself. This retrograde amnesia is of the greatest forensic importance.

To establish the diagnosis of psychical epilepsy frequently requires a great deal of acumen combined with endless patience and pertinacity. From time to time epileptics are put on trial for the most widely varying criminal acts, from petty theft to murder, for which they are in nowise responsible and of which they may have not the slightest memory. On the other hand, the plea of irresponsibility, the result of an epileptic psychosis, is often put forward by astute criminals or their counsel to shield them from the law. Consequently it behooves the medical expert to have in mind the clearest possible understanding of the epileptic psychoses with their manifold manifestations. Before one can say that he is dealing in a given case with an epileptic psychosis, he must prove absolutely by such unequivocal signs as convulsive attacks, fully marked, rudimentary or abortive, that the patient before him is really an epileptic. It has already been emphasized that the epileptic psychosis is never the first symptom of the disease, and recorded cases all go to prove farther that it does not suddenly appear out of a clear sky at some remote period in the life of an individual whose only claim to epilepsy is based on one or two convulsive attacks which occurred in infancy or early childhood.

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In the case of a crime (murder for instance) alleged to be committed during an attack of epileptic insanity and to be followed by retrograde amnesia, there are many factors to be considered before the truth of the allegation can be admitted and the irresponsibility proved. In the first place it should be remembered, as Féré has pertinently shown, that an individual may leave his house, descend his steps, cross a garden walk and then lose all memory in consequence of a shock which he has sustained on putting his foot upon the sidewalk, but this loss of memory does not prove that the individual was either unconscious or irresponsible when he shut the door of his house. In the same way an act committed under the spur of an uncontrollable passion may leave behind it a retrograde amnesia of marked degree both for the act and the circumstances leading to it, but it does not prove irresponsibility. This is particularly emphasized because there are cases on record where postepileptic retrograde amnesia and irresponsibility have been alleged and successfully sustained in defence of criminal acts, the results of pure outbursts of passion. On the other hand, it is also to be borne in mind, that an epileptic, even during the most violent period of his insane outburst, may reply to appelations and hurl at each of the onlookers appropriate objurgations, but that while this may be taken as an index of a certain degree of consciousness, it cannot also be assumed as evidence of responsibility.

In certain cases, where amnesia is not retroactive, the patient on coming to himself, with evidences of his crime on every hand, does not seek to excuse himself. But this does not always follow, and Féré and Legrand du Saulle have reported cases where the patient alleged the most palpably improbable reasons for his deeds. In other cases still the amnesia is retarded, and may not be complete for several hours after an attack.

The character of the crimes to which epileptic insanity usually leads has already been alluded to, and it is of diagnostic importance to keep in mind the fact that such crimes, as a rule, are the automatic execution of a preëxisting idea, whether normal or pathologic and that their gravity usually varies with the ordinary sanity and calling of the subject.

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If, for example, he is ordinarily sound in mind and has only professional preoccupations, his insane acts during the attack will be vastly less dangerous to himself and the community than if he is constantly unsound, subject to homicidal or suicidal impulses, or is a habitual criminal As a matter of fact, many criminals are also epileptics, and Ottolenghi goes so far as to see in the mental, moral and physical habits of many habitual criminals congenital and other evidence which tends to prove that their whole existence is one protracted "twilight" state much diluted, so to speak.

Alcohol as a factor in the production of psychical epilepsy is one of paramount importance. The epileptic brain is one which is easily upset by even small amounts of such a marked nervous irritant, and the result is frequently an attack of insanity. In cases of epilepsy due to cranio-cerebral traumatisms in which, as every neurologist well knows, intolerance of the brain for even trifling amounts of alcohol is particularly striking, it becomes a nice question as to the responsibility of the individual for crimes committed during an outburst of epileptic insanity produced directly through the agency of the alcohol. Apart from this, pure alcoholic mania has been confounded with the epileptic type. A proper investigation of all the circumstances attending the onset, together with careful observation of the patient after the attack should easily suffice to differentiate. Genuine alcoholic epilepsy usually comes on very late in life, after many years of abuse of this stimulant.

The so-called *raptus melancholicus* has in certain cases been mistaken for the epileptic accession. This form of maniacal outburst, which sometimes occurs during the course of melancholia and is marked by violent impulsions of various kinds, is to be differentiated from the epileptic variety by a careful consideration of the previous history of the case, and by the fact that the acts which immediately precede the *raptus* are never followed by that apparent tranquillity of mind which is possible in the crepuscular state of consciousness which precedes or constitutes the epileptic psychosis. In addition to this the ideas of persecution which impel the melancholic to violence are always more fixed and persistent than in the

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epileptic. Finally the intermittency of all the epileptic prodromes is in sharp contrast to the fixity of the melancholic.

Transitory mania and psychical epilepsy have so many bonds of affinity that many cases of the former are confounded with the latter. In any case the differentiation is simple, if one can establish the fact of preëxisting epilepsy, of no matter what type.

The distinguishing feature between the "twilight" condition of epilepsy and the merely somnambulistic state is that in the latter there is almost invariably lacking all impulse to deeds of violence, so common to the former.

From all that precedes we may finally conclude:

(*a.*) That the psychoses of epilepsy have very definite and immediate associations with other manifestations of the disease.

(*b.*) That vague and ill-defined convulsions, which date back to infancy or early childhood, do not constitute such other manifestations; and

(*c.*) That the plea of irresponsibility for criminal acts alleged to have been committed while an individual was suffering from epileptic mental alienation should be considered invalid, unless other and irrefragable manifestations of the disease can be adduced.

The case to be reported comes under the head of intellectual petit mal. It is of traumatic origin, and presents such clinical features as "absences" of consciousness, amnesia, and automatic acts.

The patient is an unmarried man of thirty-three years. He was born in England, of Scotch parents, and is by occupation a waiter in a hotel. The family history is free from any taint of mental or nervous disease and the patient's parents are both alive and well. There is no history or evidence of venereal disease. Up to eight years ago there was very moderate habitual use of malt liquor; little since. Tobacco, four ounces per week. Up to fifteen years ago the patient was a well man in every respect. At that time he fell from a cherry-tree, striking, he thinks, on his head. He got up, however, almost immediately and began to walk, and did not "come to himself," as he puts it, until he had gone several miles. He recognized that he had gone a long distance, but could not tell why, although he was aware that he had had a fall. He was all right after this for several years, but then began to have "fainting" spells, during which his mind was a blank. Four years ago these spells began to be preceded by a bad taste in the mouth, and as unconsciousness developed the patient would clutch at surrounding

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objects. In such attacks he has burned his hands several times by clutching at a red-hot stove. Since this time there has been pretty constantly recurring attacks of ambulatory and other automatic acts. He says that he may be walking along the street, when his mind suddenly becomes a blank, and he continues on indefinitely, knowing absolutely nothing about what he is doing or where he is going. On one occasion he remembers going into a saloon and asking some one to drink with him, but does not remember getting up to the bar. Several hours later, when he had regained consciousness, he found himself under arrest for drunkenness. His memory is poor, but between attacks he manages to do his work fairly satisfactorily. His appetite is good, and his bowels regular. He sleeps well, as a rule, but there are times when he does not sleep at all for two or three nights running, and he finds that his mind is not clear on these occasions. His eyesight and hearing have not failed. Up to this date (May 28, 1900) there has never been any attack of the grand mal variety. Examination to-day (May 28) is absolutely negative from a physical standpoint. Mentally the patient is sluggish and gives evidence of marked impairment of the memory. Close inquiry fails to reveal any hallucinatory or delusional precursors of the attacks. Subsequent notes are as follows: June 15. — Three days ago attack while riding home in cars. Did not get off at destination but continued to end of route and back again, paying two fares. Did not come to for half an hour and got home before his head was very clear. Ordered to increase bromide to gr. xx. t. i. d. June 29. — Two attacks this A.M., one here at the clinic. In this latter he sits staring at a newspaper which he holds semi-inverted, as if in the act of turning it. The pupils are equal, moderately contracted, and irresponsive to light. The face is congested, and sweat pours from the forehead; the patella reflexes are absent. He pays no attention to questions, even when they are put to him in loud, sharp tones. There are no convulsive movements. Given a pasteboard card he tears it industriously in layers, and then demolishes a block of prescription blanks, slip by slip. When nudged or shaken he merely grunts and continues what he is doing. Ten minutes after onset he answers questions somewhat, but cannot tell where he is. He is then given a promissory note for ten thousand dollars made payable to me, for value received, and asked, after reading it, to sign it. He does so, and is then asked to add the date. In response to this he looks at the newspaper in his lap, asks what the date is, and, when told, repeats his question several times ; finally adding date to the note. He is then told to read the note aloud and does so, calling $10,000 — ten dollars. He is told that the sum is ten thousand dollars and asked if he meant to sign it. He says he did. Five minutes later he is shown the note again but remembers nothing about having seen or signed it. A half an hour after the onset the patient is almost fully conscious. and remembers nothing, whatever, about the attack or anything connected with it. His knee jerks are now present and normal. The pulse and respirations have been normal throughout.

Nothing of note with reference to the case is recorded from the above date until August 6, when the following record

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was made: "The patient had an outspoken convulsive attack on the night of August 3. Given bromide gr. xx from then on. Had one or two other slight spasms. His mother let him go out alone last evening and he has not been seen since. Advised commitment to epileptic colony at Munson, when found."

In view of the general description given of intellectual petit mal it seems hardly necessary to enlarge upon the diagnostic features of this particular case. The forensic importance of such an act as signing the promissory note needs only to be mentioned to be appreciated. With regard to the attack which occurred when the patient entered the saloon and invited the person he met there to drink with him, an attack which led to his subsequent arrest for drunkenness, there appear to the writer to be two interpretations. Either that he did actually take a drink, which precipitated the attack and led to a complete amnesia of a retroactive type, or that the attack came on just as he started to take the drink. If the latter theory is correct the amnesia really goes back only to this point; but it is easy to understand that the patient himself may have believed at the time of his arrest that he had actually taken the drink and had become intoxicated thereby.

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